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Vol. V. NEW YORK, APRIL 25, 1885. No. 17.

Handsomely bound volumes of THE ELECTRICAL WORLD *for* 1884 *are now ready, and will be sent, charges prepaid, to any address on receipt of* $5.00.

As an earnest of its desire to put wires underground wherever the conditions admit, the Metropolitan Telegraph and Telephone Company is still at work extending its subterranean system.

INTEREST is maintained in England in the application of electric motors. Another trial has been made with the Reckenzaun electric tram-car, with satisfactory results, and the Holroyd Smith system in use at Blackpool will soon be in regular operation.

So great has been the crush in the evening at the exhibition of the International Society of Electricians, at the Paris Observatory, it has been necessary to erect barricades for the purpose of keeping the crowds in regular circulation and for preserving order. The exhibition at Philadelphia last year showed just as clearly the deep interest taken nowadays by everybody in electrical matters.

A GREAT impetus to the use of the electric light afloat has been given by the desire of the English naval authorities to be prepared for a war with Russia. Several of the gunboats are now being fitted with lamps and dynamos, and an installation is part of the equipment of every new man-of-war. We note, too, that preparations are being made for firing the guns of one of the gunboats by electricity.

IT is said now that there are many objections to the use of the Bartholdi Statue of Liberty as a light for New York Harbor. We have always understood that the idea of "Liberty enlig htening the world" included in it this practical application. Still, if the statue cannot be employed as a lighthouse, in which capacity it would certainly lose none of its idealistic and symbolical character, electric lights might be grouped near the feet so as to illumine the face or figure after dark.

THUS far the American Bell Telephone Company has come fairly well out of the ordeal of investigation through which it has been put in New England. We give to-day the evidence of Mr. Theodore N. Vail, before the Massachusetts legislative committee on mercantile affairs. It will be found very interesting. The opinion is prevalent in New England that the company will be allowed to increase its capitalization. Meanwhile the agitation in various parts of the country for lower telephone rates has gained ground, and a reduced income might make it very difficult to pay good dividends on the increased stock.

A BILL has been introduced in the New York Assembly to regulate telephone rentals. It is provided that no company shall charge more than $3 per month for one telephone, or more than $2.50 where more than one telephone is rented by one individual. It is further provided that where any two cities, villages or localities are connected, not more than 15 cents shall be charged for the first five minutes, and not more than 5 cents for each additional five minutes. This piece of legislative dishonesty is on a par with that attempted by the Indiana Legislature. We do not anticipate that the bill will become a law.

THE statement is made by Mr. Charles H. Botsford, in a letter to the president of the Gas Consumers' Association, that during the last ten years the people of New York have been charged $75,000,000 for gas that cost only $40,000,000 to manufacture and distribute. These figures might well make the mouths of electric-light men water, but it seems to us that one of the best means for the public to adopt for preventing the continuance of such large profits is to foster electric lighting, so that the two illuminants will, by their competition, insure a cheap light to the consumer. This view of the case is respectfully submitted.

THE New York papers still teem with articles on undergrounding the wires, but as far as we can trace the real utterance of public sentiment the interest displayed is largely artificial. In acknowledging the receipt of the resolution of the Health Department against excavations, the Commissioner of Public Works, Mr. Squire, has avowed his belief that the dangers to the public from breaking open the streets is overestimated. He says, too, that he will consider it his duty to carry out the underground law, and compel the companies to remove their wires from the poles and roofs. The intention of Mr. Squire may be good and laudable, but the law must be greatly modified before any one, however determined, can carry it into effect.

WHEN half a dozen of the leading railroad capitalists in the country undertake to examine electric motors and to express themselves in favor of the use of electricity on elevated roads, it is time to believe that something is about to be done. We note elsewhere the visit of a number of magnates to the Bergmann factory in this city to inspect motors there. Mr. Gould is reported to have said at the time: "I think electricity will be successful as a substitute for steam as a motive power on the elevated railways. I am not prepared to go so far as to say that the change can be made on ordinary railways, but I have no doubt that it can and will be made on the lines of the Manhattan Company." Very good, indeed, but what does that mean, coming from such a source? Is it casual conversation or the expression of a resolve already taken?

MOST men taking any kind of pride in their work are willing to make a spurt when occasion requires, and to bend themselves to it temporarily with redoubled effort; but very few men are willing to go on doing extra work steadily without compensation, especially if they know that other men elsewhere similarly situated are being paid. Hence little surprise need be felt at the attitude of the telegraph operators of Chicago, who get no pay for extra work, while their brethren in New York have a regular allowance. But Chicago is not the only centre of disaffection. Complaints, protests and threats are heard all along the main lines, and if the talk on the subject signifies anything, grave troubles are not far off. It is devoutly to be hoped, however, that the country may be spared a repetition of the experience of 1883, and we would advise the adoption of a policy of conciliation on the side of the employers.

IMPROVEMENTS and reforms in the Patent Office and the patent law are now attracting attention, as well they might, after the exposure we gave recently of the disgraceful manner in which the office is equipped and housed. It is well known that the staff is too small for the work, but the proposal is made to reduce the work by issuing patents only for inventions of value. This would hardly please the ordinary inventor, who always deems his new idea to be of the utmost value, and who would resent any curtailment of the present freedom with which patents are granted. Besides, it is not easy to say whether an invention is important or insignificant. Other proposed reforms tend in the diametrically opposite direction, involving the issue of patents to everybody on everything for a mere registration fee of $1, without any examination. This is urged on the ground that the patent which now costs a poor inventor, say, $50 in fees is worthless, and that he might just as well have it for $1. Our opinion is that if the office were allowed to spend its own earnings on itself most of the evils would be remedied, and that inventors would be better satisfied with the law and with the treatment they receive. The talk about the little worth of patents as protection is the sheerest nonsense. Some of the largest concerns in the country stand to-day on a foundation of patents, and could not exist without them, while many an inventor of small devices is drawing a good income in royalties from his patent.

IF what the newspapers say be true, the atmosphere of Murray Hill, New York's most eminently respectable quarter, is just now "impregnated with electricity," because of the multiplication of electric light wires there; and the people are rather priding themselves on the abnormal conditions under which they manage to live, move and have their being. But Murray Hill has nothing to boast of that will compare with the "atmospheric electric current of considerable power" that has been frisking about the Northwest. This current, it is just reported from Frankfort, Dak., traveled at a height of from four to six feet above the ground. As it went it buzzed, snapped and sparkled. Teams became unmanageable with fright, and oxen were scared out of their wonted propriety. One man, who thought his startled horse had the blind staggers, bled it and tried to pass it off on an unsuspecting stranger. Stock generally was as "tricky" as though it belonged to a circus, and, had not the current passed over, its effects on the human inhabitants of the region would also have been serious. The current flowed from west to east, and was six or seven miles in width. The local papers omit, however, to state how thick it was, how long it was, what it weighed to the yard, and what its color and smell were. There appears to have been no scientific observer on the ground, and hence a grand opportunity was lost of ascertaining the true nature of electricity. Still, as the current is traveling on, we live in hopes of hearing more about it.

AT the present rate of 24 cents per 20 words, the address being free, 24,000,000 telegrams are sent annually in Great Britain. The new rate comes into operation next August, when every word, including the address, will cost one cent, no message being sent for less than 12 cents. It appears that the average length of the message now is 17 words, while the average address—not charged for—contains not less than 11 words, or a total of 28 words to each message. We do not wonder that the cost is 20 cents per message. It is hard to understand why, in a little place like England, a man can't be found without an address of eleven words. But the government, in order to meet the demand for cheaper telegrams, has wisely conformed to the practice of Continental Europe, and made up its mind to charge for every word. Brevity and condensation will now be the order of the day. The calculation is made that the words outside the body of a message can be reduced to 5, leaving 7 for the information sent. It is thought that about one-third of the messages now averaging twenty-eight words will fall within this narrower schedule; that the cost on the average message will be nearly eighteen cents, and that the average increase of business will be about one-third. Great doubt is entertained in some quarters as to the profitableness of the new system. It is said that the telegraph is by no means a necessity to the "humbler classes," and that low rates will not tempt them to spend their money on it more than they do now. But we trust that the step taken is in the right direction, and, while we have no fondness for government telegraphs, we shall be glad to see this experiment in England succeed. It will be closely followed by American observers.

REVIEWS OF NEW BOOKS.

Electric Illumination. Vol. II. With Abstracts of Specifications (Patents) Having Reference to Electric Lighting. *Edited by James Dredge.* New York: John Wiley & Sons. 1885. 776 pp., quarto. Price, $7.50.

When the first volume of "Electric Illumination" appeared, about two years ago, it supplied a want which was felt among those who, having been drawn toward the promising field of electricity, and electric illumination in particular, found themselves at a loss for a work which could present to them in a concise and comprehensive form what had been done before and some time after electric illumination was placed upon a commercial footing. The task of wading through a large mass of periodical literature, in which the principal contents of the book are to be found, was evidently a hopeless one, and thus the appearance of the work was hailed with delight. It at once took its position among the standard works on the subject. Indeed, so great has been the demand for the first volume that the edition is now exhausted, and if no other follows it, the book may well attain an increased value as a rarity.

In glancing over the second volume we must confess to a certain disappointment in relation not to what the book contains, but to that which it does *not* contain. The end of the preface to Volume I. stated correctly that the limited space rendered it impossible to touch upon all the points connected with electric lighting, and that the volume to follow would deal "largely with the applications of the electric light and cognate subjects; such as cost of production and maintenance, photometry, secondary batteries, accessories, motive power, etc."

Of all these good things promised, not all appear as accomplished, as it would be difficult to conceive in what manner the cost of production and maintenance and motive power are to be taken as treated of in the present volume. We may console ourselves upon their loss, however, by considering them as *cognate* subjects, and, therefore, of lesser importance. But, strange to say, not a line appears which can be considered as applying to secondary batteries as such; for although mentioned in connection with the chapter on electrical measurement, they have received no extended treatment whatever. This, evidently, is a grave omission, and one which is to be deplored the more that, had it been treated, we venture to say, it would have proved one of the most interesting and important chapters of the book. Indeed, the subject is such an important one that it is remarkable it should have been overlooked in the face of its promised appearance. If we may be permitted to suggest how to supply the omission, a remedy would be found in a supplementary volume, which, no doubt, could be made as attractive as its predecessors. Our hope in the appearance of such a volume is strengthened from the hint thrown out at the end of the preface to this volume, that as the abstracts of patents are brought down only to the end of the year 1883, they may be continued up to date "on a subsequent occasion."

The present volume is divided into four principal sections, in all of which the subjects treated of are presented in a complete and eminently practical manner.

Section I., *Electrical Measurement*, is undoubtedly modeled on an excellent plan, and one which is worthy of imitation. It begins with an *exposé* of the general principles underlying electrical measurement, and deals with units and their derivation in an eminently lucid style. The laws having been defined, the principal instruments in which their applications are embodied are next considered, and these are followed by practical methods describing their use and the results obtained by them. It would require too much space to enter into the details of this excellent chapter, from which, although limited in space, nothing has been omitted which is essential to a correct understanding of the subject of electric light measurement. Not the least important part of this section are the practical examples added to the description of the methods, a feature that cannot fail to commend itself to the student. The close of the section is occupied by a few pages relating to works on electricity and electrical measurement, in which a number of the best books on the subject are enumerated and the nature of their contents briefly stated, so that the inquirer may be guided in his selection.

Photometry forms the subject matter of the second section, which is for the most part a reproduction of what appeared in a series of articles in *La Lumière Electrique*; but there are a number of additions which increase its value for English readers. In this chapter, after explaining the laws governing photometric measurements, the different varieties of photometers are described in detail, comprising all those that have attained any prominence whatever. Luminous standards are also treated of, but as the book went to press before the adoption of the recent standard, the latter is not stated as accepted, but merely proposed by MM. Violle and Cornu. The student will find this excellent chapter to contain a large amount of valuable information on this subject, some of which cannot be met with in any book published of which we have knowledge. This is followed by a short chapter on the *Eye as a Photometric Instrument*, in which the structure of the eye, its properties and functions, are treated of in a very interesting manner.

As an accessory to electric lighting, *Dynamometers* occupy a place in the book, forming the subject of a chapter in Section III. Here the principal forms of absorption and transmission dynamometers are described in regular order, conveying a good idea of what has been done in this field, and forming a suitable conclusion to the two preceding sections, in which the measurement of energy in two other forms has been treated. A thorough knowledge of the measurement of electric and mechanical energy and that of light is essential to the electrical engineer, and all three are here considered in a complete manner.

In order to show the practical application of the foregoing sections a chapter is devoted to *A Testing Installation*, in which every detail of the plant established by Mr. C. F. Heinrichs for the testing of his dynamo is described. This will give an excellent idea of the manner in which such an installation should be arranged, and of the character and scope of the results to be obtained therefrom.

Since the first volume made its appearance, electric

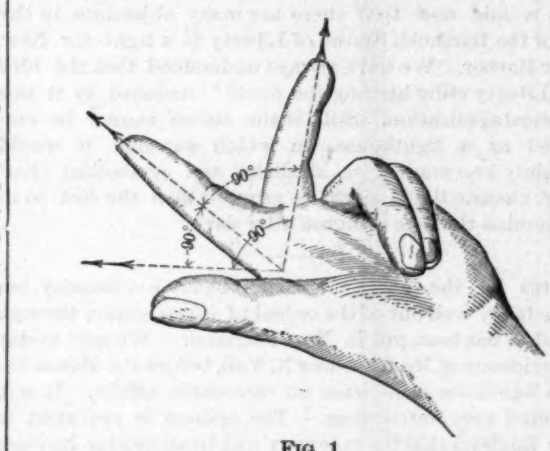


Fig. 1.

lighting has by no means been at a standstill, and numerous forms of dynamos and lamps have made their début and deserve attention. It is to these that the last section of the book is devoted, the growth of the subject requiring a space of 180 pages for its record. This part of the book will be found especially interesting to American readers, as a number of systems developed here are fully treated, among them the Hochhausen, the Weston, the Edison and the Brush incandescent in their latest phases. The Gaulard and Gibbs system of electric distribution by secondary generators, the Zipernowski system, the Ferranti dynamos, and a number of others are described, with details of the results obtained from them. The more recent arc and incandescent lamps close the section, which contains all the improvements of note made during the last two years.

As stated in the title, the latter part of the volume is occupied by abstracts of specifications of patents granted in England relating to the subject of electric lighting, and brought down to the close of 1883. This constitutes a most valuable and instructive record, and affords a ready means of reference for American inventors who may desire to inform themselves of the work of their English cousins. The final appendix to the book gives the electrical and photometric tests, made at the Munich Electrical Exhibition, and contains a short history of photometry by Dr. H. Kreuss. As the author states, the official reports of these tests form a valuable contribution to electrical literature, and as such deserve a place outside of the periodical literature of the day, in which they have thus far appeared.

The contents of the book being for the most part accurately descriptive, there is little that calls for criticism.

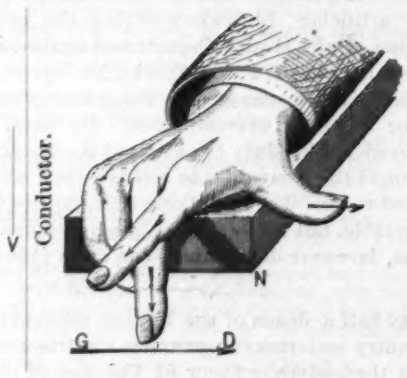


Fig. 2.

In going through its pages, however, we note a few points to which attention might be called. On page 31 there occurs what is evidently a slip of the pen, the author speaking of the electro-chemical equivalent of a substance as the mass liberated at the *negative* electrode by the passage of a current; manifestly, *positive* is the term intended. At the bottom of page 43, the letter designating the angle θ has been omitted, and on page 57 the expression, "wire, uncovered with silk," is somewhat ambiguous.

In addition to the omissions noted above, we must add that of the *three-wire* system of electrical distribution, of which no mention is made. We can only explain this on the assumption, before expressed, that a succeeding volume will treat of this as well as the other subjects mentioned.

If we may be allowed to suggest an improvement, it would consist in subdividing the chapters more distinctly, and in providing a table of contents paged accordingly. The paging of the part devoted to patents and the appendices is denoted in Roman numerals. It requires somewhat of a mental effort on the part of the average reader to follow this style of enumeration, and consequently makes it more difficult to hunt up references. We note also an error in the paging here, the page cccIxxxiii. being designated as cccxxxiii. The plain Arabic would be an improvement, in our estimation, for although designated as an appendix, the space it occupies and its importance are sufficient to entitle it to Arabic numerals.

Like Vol. I., the present book leaves nothing to be desired as regards its make-up. The letterpress, paper and style of binding are uniform with those of its predecessor, and the illustrations, 500 in number, are equal to, if not better than, those in Vol. I. The value of good illustrations to elucidate the text is fully appreciated by the author, and the result is a book giving a remarkably clear idea of the subjects discussed.

Taken as a whole, Vol. II. is a decided accession to electrical literature, and we have no doubt will be received with the same favor as Vol. I. We venture to hope that Mr. Dredge's labors will not cease here, but that he will in the future continue, from time to time, to collect into concise form the improvements which are constantly being made in this fast-extending field.

How to Remember the Direction of Currents.

The study of the theory and construction of the dynamo and kindred machines is now being undertaken by a large number of persons, who find themselves attracted toward the promising field which has been opened in this direction. In studying the effects of electro-magnetic induction upon conductors, however, beginners often find difficulty in tracing the direction of the induced currents, and much vexation and disappointment is the result. It is true that nearly all text-books on electricity give directions for determining the required point, employing, in most cases, the analogy of a man swimming, but the rule is difficult to remember and in addition requires a stretch of the imagination to apply it. Such a rule, in order to be of any assistance, must evidently be easy to recall to mind and exhibit the result in a graphic manner. Dr. J. A. Fleming has recently shown in a very simple manner how the direction of the current can be easily determined when the direction of the magnetic lines of force and the direction of the line of motion are known.

For this purpose the thumb and the first two fingers of the right hand are employed. The first finger or index is pointed straight out and the thumb placed at right angles to it, as shown in the cut, Fig. 1. The middle finger is then bent at right angles to the two former, so that the fingers represent as nearly as possible three axes at right angles to each other, as will be understood from the figure.

Then if the forefinger be placed so as to point in the direction of the lines of force, and the thumb pointed in the direction of the line of motion, the middle finger will show the direction in which the induced current flows. It must be remarked that the lines of force here mentioned apply to those emanating from a *north* pole. Fig. 2 shows this in a clear manner. The arm placed in line with the magnet, the forefinger points in the direction in which the lines of force radiate from the north pole. The thumb, pointing out towards the right, shows the direction, *G D*, in which the wire moves; then, as stated, the current induced in the wire is in the direction towards which the middle finger points—*i. e.*, downwards. It is evident that in whatever position the lines of force radiate, or the wire moves, whether horizontal, vertical or inclined, the fingers can easily be accommodated to the position by twisting the hand at the wrist until the required position is reached.

If the pole be a *south* instead of north, the finger must be pointed toward the magnet instead of with it, in order to give the direction; or the hand may be left in the same position, with the recollection that the current will then be in the opposite direction to that in which the middle finger points.

This rule can be easily applied to dynamos, but if required to point out the direction of currents in motors, the *left* hand must be employed.

This is apparent when we consider that in the dynamo, motion through a field of force induces current in a conductor, whereas in the motor, current traversing a conductor induces motion. According to Lenz's law these motions are in opposite directions, and hence, knowing the direction of current in the motor, and the left hand being the reverse image of the right, the direction of the motion will be indicated by the thumb. Or, assuming the direction of motion, the middle finger of the left hand, as before, gives the direction of the current. In general, therefore, the right hand applies to dynamos, and the left hand to motors. The rule may be memorized by taking the FORE finger to represent the direction of the lines of FORcE, the thuMb to represent the direction of Motion, and the mIddle finger the direction of the Induced current.

A Little Strike Ended.—A dispatch of April 16 from Buffalo says: Manager Buell, of the Bankers & Merchants Telegraph Company, has applied to the receiver in New York, who has promised to settle the claims of the striking employés this week. Upon this understanding, the men went to work, and business is being carried on as usual.

To Whom Belongs the Credit?

It frequently happens that several inventors have worked in the same channel. Not infrequently, too, an invention of merit is found to closely resemble something which had been *attempted* before, but which was never brought to a successful practical issue. Recently several such instances have come under notice, prominent among which is that of the Phelps induction telegraph, which was described in one of our recent issues. Our article, which was reproduced in the English journals devoted to electricity, has called forth a letter from one of their correspondents, from which we extract the following:

"In the absence of earlier dates, I may state that this system of communicating with moving trains by means of electrical induction, almost exactly as described, was invented by me as far back as 1881, and actually tried electrically far enough to prove its complete feasibility.

"My object was chiefly to provide an efficient means of fog-signaling, by enabling the signalman to communicate directly with the drivers or guards of moving trains.

"I proposed to run a wire along the permanent way, parallel with the rails, and to wind a coil of wire round the engine or carriage, to be communicated with in such way as to get as long a length of wire parallel to, and as near to, the line-wire as possible, so as to be well exposed to the inductive action thereof, exactly as is now done. I then proposed to place in the signal-boxes a battery, signaling key, and rapid 'make and break,' or 'buzzer,' as your account calls it, and to thereby signal to the train, using a telephone on local circuit with the car-coil as a receiver. By using an ordinary carbon transmitter on direct circuit with the line wire, I also arranged and found it quite practicable to speak verbally to the train, so as to be heard distinctly in the telephone or telephones in the 'car-coil' circuit.

"This design was embodied in a paper which, in the year 1881, I laid before the managing director of the United Telephone Company. Want of time and opportunity alone has prevented it being put into practice. It was also tried practically at that time, using wire coils, properly proportioned in length, resistance and distance apart to the conditions that would be obtained in practice. The trial was certainly not made on an actual moving engine, but the fact of the coils remaining stationary instead of moving could, of course, make no possible difference, since the speed of the fastest engine is practically *nil* compared to the rate at which the contiguous particles of a line wire are affected by an electric current, *i.e.*, the 'speed' of the current. It has also been since simplified and arranged to produce both visible and audible signals on the engine or car by induction from a No. 8 iron line wire across a space of six inches, and using a current of only ¼ ampère, that is, such as can easily be produced by the ordinary Daniell batteries used in railway work. The signals are also undisturbed by great vibration.

"The possibility of communicating with moving trains by means of electrical induction was also suggested by Mr. Willoughby Smith, in a paper read before the Society of Telegraph Engineers last year, so that the principle can certainly not now be called new."

Accepting the above statements as true, they show a remarkable coincidence in the methods employed for securing the desired end. It will be remarked, however, that so far as a realization of the scheme went, nothing was accomplished. The correspondent quoted *proposed* to employ all these means, and the *practical* trial consisted in inducing a current in the *stationary* coil. The assertion that "the fact of the coils remaining stationary, instead of moving, could, of course, make no possible difference, since the speed of the engine is practically *nil*," etc., is quite refreshing. Theoretically, we admit there is no difference, but practically, a wide gap intervenes between a successful laboratory experiment and its application on a commercial scale. The history of the majority of inventions shows that their first forms were rarely the ones adopted for practical use, and that the principles being enunciated, it required a large amount of labor to perfect them and to establish their tried value.

Leaving aside the question of priority of invention, there can be no doubt to whom the credit is due, as the mere suggestion of the methods to be employed to obtain a certain object, though worthy of full recognition, does not by any means solve the problem.

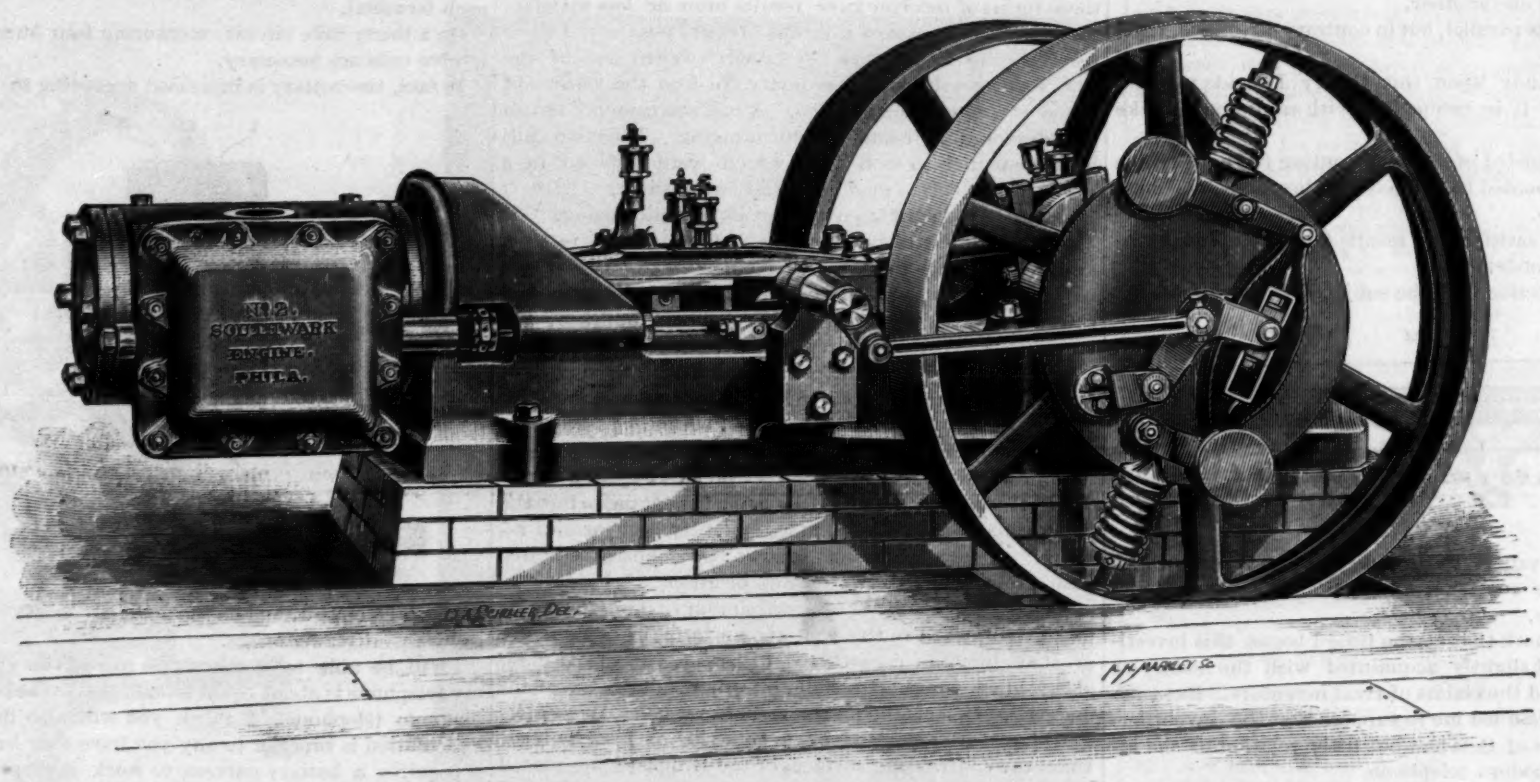
Mr. Phelps has demonstrated practically that communication can be maintained with moving trains, and the continued success of the undertaking, which is in daily operation, requires recognition, in spite of the *attempted* or *proposed* work of others.

The Southwark High-Speed Engine.

Our illustration represents a new high-speed engine adapted to electric lighting, which has recently been brought out by the Southwark Foundry and Machine Company, of Philadelphia, Pa.

Its most distinct feature consists in the novel governor adopted. The valve itself is of the slide pattern and is balanced by a cover plate, being in fact a species of piston valve. It will be noted that no eccentric is employed on this engine, but the peculiar device shown on the governor wheel determines the travel and position of the valve and changes its point of cut-off from zero to five-eighth stroke. When the engine is running, the springs are compressed and their tension is adjustable by means of a nut and screw, the latter abutting on the inside rim of the wheel. This arrangement of springs is considered by many to be an advantage over the usual method of having them under tension, and is said to insure durability and smoothness of working.

The engine is built throughout in a substantial manner and all its parts are balanced. The connecting rod is bolt ended at the crank end and has a strap at the other. Lubrication has also been thoroughly provided for and all details have been carefully studied.



THE SOUTHWARK HIGH-SPEED ENGINE FOR ELECTRIC LIGHTING.

The Electrical Discharge in Gases.

Dr. Arthur Schuster, F. R. S., in his Bakerian lecture recently delivered before the Royal Society as reported by *Engineering*, supported the theory that the conduction of electricity through gases is more probably due to a process resembling electrolytic conduction in liquids than to the direct passage of electricity from one molecule to another. His experiments on the discharge in mercury vapor argue strongly in favor of this view. By the kinetic theory of gases a molecule of mercury vapor consists of a single atom which is incapable of vibration, and though the fact that mercury has a very brilliant spectrum points to some incompleteness in the theory, still the theoretical conclusion is borne out by the fact that the vapor density of mercury vapor is anomalous. If, as is generally supposed, the molecules of the majority of gases contain two atoms, that of mercury can only contain one. At any rate, we are justified in asserting that the molecule of mercury vapor has a simpler composition than that of most gases. If, then, an essential part of the glow discharge is due to the breaking up of molecules, as in electrolytic action, we might expect mercury vapor to present simpler phenomena than the gases which are usually employed in discharge tubes. This is found by Dr. Schuster to be the case, for if the mercury vapor be sufficiently free from air, the discharge through it exhibits no negative glow, no dark spaces, and no stratification. It is, in fact, a continuous stream of light. Dr. Schuster has reason to believe that the vapor of sodium resembles that of mercury under the discharge, and from the fact that at the temperature of the spark sodium shows its live spectrum instead of the bands, he considers that the molecule of sodium is also monatomic.

The Automatic Signal Telegraph Stock.

A decision involving an important point in the construction of a statute has just been handed down by Judge Andrews in Special Term, this city. Gen. Alexander Shaler was the president of the Automatic Signal Telegraph Company, and the owner of 291 of its shares, some of which were issued to him in payment of his services, a certain number being given him whenever a money dividend was declared to the stockholders. The Automatic Signal Company having sold its property to its rival, the Watkins Automatic Signal Telegraph Company, for one-third of the capital stock of the latter, Gen. Shaler objected to the sale. He brought a suit in the Supreme Court to have it set aside, or for the alternative relief that 855 shares of the company of which he was president, remaining in its treasury, should be distributed to him and his fellow-stockholders, and that the shares of the Watkins Company, paid for the property purchased by it, should also be divided among the same persons proportionately to their several interests in the stock of the seller corporation. The two companies defended themselves on the ground that the sale was legal and that Gen. Shaler had no valid title to the stock of the Automatic Signal Telegraph Company that was given him for his services.

The case was tried before Judge Andrews in Special Term, and he has rendered a decision to the effect that the sale of the property of the first-named corporation to the second-named corporation was legal, notwithstanding that a majority of the trustees of the one also formed a majority of the trustees of the other. Such a relation of the contracting parties, one to the other, he says, does not of itself prove a fraud. He also holds that it was not necessary for the stockholders of the seller corporation to give their written consent to the sale at a meeting called for the express purpose of obtaining such written consent, although that was decided to be the law in Reiff against the Western Union Company. The decision in that case, Judge Andrews says, was based on a printed copy of the statute in which a comma was misplaced. A certified copy of the original statute shows by its punctuation, in his opinion, that the legislative intent was that three-fifths of the stockholders of a corporation should approve of the sale of its property, either in writing, done anywhere, "or by vote at a general meeting duly called for the purpose."

Having thus disposed of Gen. Shaler's charge of fraud, Judge Andrews holds the defense, based on the ground that Gen. Shaler was not entitled to the shares issued to him by the Automatic Signal Telegraph Company in compensation for his services, to be unsound. His conclusion is, therefore, that the Automatic Signal Telegraph Company shall distribute among its stockholders its own stock held in its treasury, and also the Watkins Automatic stock received for the property sold by it.

Taylor's Electric Telephone.*

BY THEO. F. TAYLOR.

In the present paper I propose to tell what I know of the telephone.

Having made alleged improvements in that art, and having been so fortunate (or otherwise) as to have obtained from this and several foreign governments letters patent for the same, it is natural that I should take pride in explaining my invention to my electrical friends.

Before going any further, however, I wish to make an announcement which may startle you all and relieve the minds of some. I do not claim to be the original inventor of the telephone.

While half the States of the Union claim that honor for one of their sons, my native State of Delaware makes no such claim.

I am only a gleaner in a field already harvested!

My first effort in the line of telephonic invention was made several years ago, when it occurred to me that a receiver might be constructed on the principle of the attraction and repulsion of currents.

In the text-books the attraction and repulsion of currents is treated under the head of electro-dynamics, and under this is understood the laws of electricity in a state of motion, or the action of electric currents upon each other and upon magnets, while electro-statics deals with the laws of electricity in a state of rest.

The action of one electrical current upon another was first investigated by Ampère, shortly after Oersted's celebrated fundamental experiment.

All the phenomena, even the most complicated, follow from two simple laws, which are:

1. Two currents which are parallel, and in the same direction, attract one another.

2. Two currents parallel, but in contrary directions, repel one another.

After some study upon this theory I made my first model, and tried it in connection with an ordinary Blake transmitter.

The model consisted of two confronting flat coils of fine copper wire, cemented to two hard rubber discs, and held in a wooden case.

Not obtaining satisfactory results with an induced current, I laid this model aside.

My next connection with the subject was when I was requested as an expert to investigate the researches of Phillip Reis,—to construct and operate the instruments described by him.

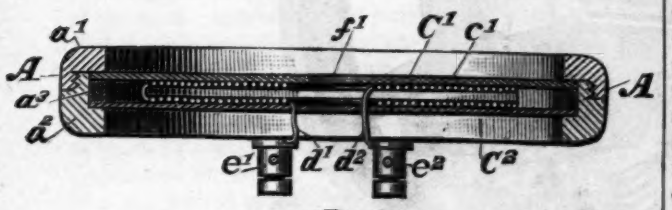


Fig. 1.

I will here remark that at the time I began this investigation I was but slightly acquainted with the history of the telephone and the claims of rival inventors. But such knowledge as I had led me to suppose that the inventions and publications of Reis had but little relation to the invention of the modern telephone.

I constructed all the forms of transmitters and receivers described by Reis and succeeded in making them all transmit and receive articulate speech. The lectures and papers of Reis prove him to be the original inventor of the telephone. He was not only the inventor—he fully understood the principles of their operation and construction. He imparted his knowledge to others in the plainest language. He invented a name for his instruments. He called them "The Telephone." My feelings are strong on this subject, because I am not only indebted to Reis for instruction in the art, but it was one of his transmitters that first made my receiver talk. It has been the fashion to belittle the inventions of Reis, for the reason that they failed to become of any commercial value under his hands. He was looking for scientific and not financial success. I have never heard the great discoveries of Newton belittled, for the reason that he failed to apply for a patent on gravitation.

My experience with Reis' instruments made me familiar with battery transmitters, and on connecting one with my old model I heard it talk and was encouraged to develop it.

In explaining my invention I cannot do better than quote from my application for a patent:

"My invention is based on the well-known fact that electric currents when they are caused to traverse neighboring parallel conductors in the same direction exert upon each other an attractive force, and when in opposite directions a repulsive force; and the degree with which they so attract or repel is dependent upon the proximity of the conductors and the strengths of the currents.

"When, therefore, the positions of the conductors are approximately constant, the variations in force may be considered as depending upon the variations in strength.

"Parallel results are obtained when an electric current is caused to pass through a single electric conductor in proximity to a continuation of itself.

"Upon this principle the invention is essentially based, and it consists generally in so disposing an electric conductor that different portions of its length are brought into proximity to each other, and a current of electricity caused to traverse the same will pass and repass in approximately parallel directions or in opposite directions through such different portions."

Without further explaining the principles upon which my receiver is supposed to work, I will describe in a few words some of my early experiments.

My first model consisted of two flat coils of fine wire cemented to hard rubber discs. To demonstrate the principle I then procured an old violin (which I have here), and stretched two fine steel music wires (of No. 26 gauge) over the bridge, and made the connections so that the current traversed the wires in the same direction.

Upon using a quantity current I found this instrument reproduced speech, although faintly. I then cemented a flat coil to an ordinary butter dish about two inches in diameter, also to glass and mica plates. Another form was made by cementing wire inside a thin glass tumbler. All these forms of receiver gave results more or less satisfactory. When a mass of iron was brought near any of these receivers the sound was reinforced. When one of the coils was placed upon an ordinary flat-iron the volume of sound was more than doubled. A coil was cemented to an iron disc, and the result was encouraging. Then two coils were cemented to iron discs which were fastened in a wooden case. This made an excellent receiver.

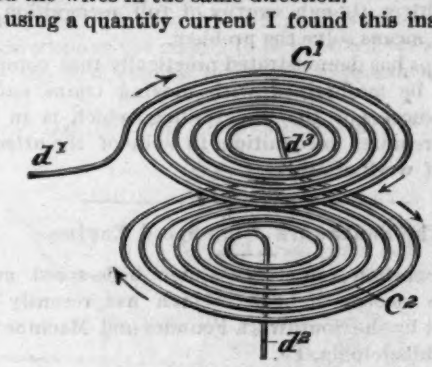


Fig. 2.

The attraction between these coils is quite strong.

Here is an illustrative model in which one coil is fixed and the other free to move. On connecting the battery you see one coil move toward the other. With this form of receiver the reproduced speech was clear and faultless. The consonants were properly reproduced. Such words as "sunset," "fructify," "pencil," etc., were faithfully rendered. One form of receiver was made of iron wire in flat coils and responded to induced currents. Another form was made of both iron and copper wire laid parallel and made into a flat coil. This was not very good. I sought to increase the volume of sound by using large discs, but the voice sounded muffled and indistinct. My best form of receiver is now made as follows: Within a suitable case are supported two plates or discs 2¾ inches in diameter, which may be of metal similar to the diaphragms usually employed in the well-known forms of telephones, or they may be constructed of paper, vulcanized fibre, glass, mica, wood, porcelain, or other suitable resonant material. One of the plates is perforated at its centre. The plates are separated by a thin ring of hard rubber. Upon the confronting surfaces of the two plates are placed two flat coils of No. 36 copper wire, fastened by shellac varnish, and they are connected with each other in such a way that a current of electricity entering one terminal will pass through the coils in succession, and through the convolutions of the same in parallel directions.

While a steady current is flowing the two coils and plates will be attracted toward each other, by reason of the attractive force exerted by the two broad streams flowing in the same direction.

In action this attractive force is variable by reason of the variations in the strength of the current, which are caused by the action of the transmitter. These variations cause vibrations on the part of the receiving instrument capable of producing sound waves or sonorous vibrations corresponding to those by means of which the current vibrations were originally occasioned.

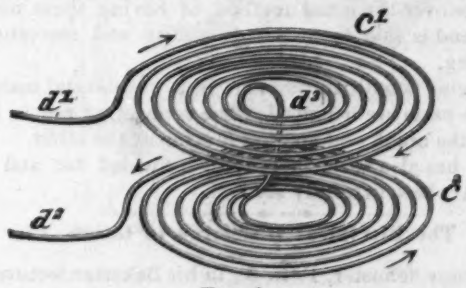


Fig. 3.

In Fig. 1, *A* represents a case of hard rubber for supporting the several parts of the instrument. This case is constructed in the form of a wide ring in two sections a^1 and a^2 adapted to be screwed together as shown. Within the case *A* are supported two plates C^1 and C^2 of metal. One of these plates, C^1, is perforated at its centre, as shown at f^1. The plates are separated a slight distance from each other by means of an intervening ring a^3. Upon the confronting surfaces of the two diaphragms are cemented two flat spiral coils of wire, as shown at c^1 and c^2.

In Figs. 2 and 3 two different methods of connecting the spiral coils are illustrated. According to the plan illustrated in Fig. 2, the current is caused to enter at the terminal d^1 and to pass in the direction indicated by the arrows from the exterior to the interior convolution of the spiral coil c^1, the direction in each convolution being parallel to the direction in the neighboring convolutions. From the interior convolution the current passes through the connecting portion d^3, to the outer convultion of the spiral coil c^2, and in the direction indicated by the arrows through its several convolutions to the terminal d^2. It will be seen thus that the current is caused to traverse both conductors in parallel directions, and the two spiral coils will be attracted toward each other by reason of the attractive force exerted by the current upon itself in the several portions of the conductor.

In Fig. 3 an organization is illustrated in which the connections of the two spiral coils are so changed that the current is caused to traverse the same in opposite directions; from the interior convolution of the spiral coil c^1 passes directly to the interior convolution of the spiral coil c^2, and thence to its outer convolution. The relative directions are thus reversed. The operation of such an instrument is precisely similar to that described in connection with Fig. 2, with the exception that the variations in the repulsive force of the two currents are here availed of, in so far as the two spirals may act upon each other, instead of the like variations in the attractive force. The results obtained are, however, essentially the same in either case.

A Hugbes microphone with four contacts is used for a transmitter. The transmitter I shall use this evening has been used in my experiments for the past six months, without any adjustment, with from one to thirty cells of Fuller battery, under all conditions. On ordinary circuits, say up to two miles, four cells of Fuller battery are used at each terminal.

On a thirty-mile circuit, measuring four hundred ohms, twelve cells are necessary.

In fact, the battery is increased according to the resistance of the circuit, and as the percentage of variation at the transmitter decreases.

Fig. 4.

I will be able to demonstrate to you this evening that my telephone is about equal in loudness to the best modern magneto telephone. I think you will also find that its articulation is superior to any you have ever heard. Since it requires a battery current to work it properly, it does not respond to induced currents to any great degree. Therefore, it does not pick up all the neighboring currents and annoy the listener with the "frying" and crackling sounds present in magneto-phones in our large cities. And because it is a battery phone it works as well over an underground circuit as over a pole line. In fact, I have the assurance to hope that I have solved the problem of underground telephony. I will now let the instrument speak for itself.

* A paper read before the New York Electrical Society, April 23, 1885.

Danger from Dynamos.

In our recent issues the subject of danger from dynamos was treated at some length, M. d'Arsonval, among others, entering into the discussion of this important matter. Recently M. d'Arsonval has communicated to the French Academy of Sciences a further experiment which he has made with a dynamo to find out an efficient means of rendering the extra spark on breaking circuit non-injurious to life. Between the terminals of a Gramme dynamo giving 30 volts electromotive force and 2 ampères of current, he connected a lightning protector of two metal discs 10 centimetres in diameter, and insulated from each other by a simple layer of shellac varnish. At the instant of breaking the circuit, neither the spark nor the shock was sensibly modified; but thinking this due to the small capacity of the condenser, he replaced it by the condenser of a Ruhmkorff coil giving a spark of 15 centimetres. Under these conditions the spark of rupture was greatly reduced, as one might expect; but curiously enough, the energy of the shock was considerably increased, and killed a guinea pig after eight or ten ruptures of the current. Hence he infers that while the interpolation of a condenser between the terminals of a dynamo diminishes the chances of deterioration of the machine by the extra current of rupture, the arrangement increases considerably the danger of the machine to the operators. This plan for suppressing sparking was embodied in an English patent for 1882.

Cable Censorship in San Salvador.

A letter from the Republic of San Salvador, under date of March 31, gives some particulars as to the cable censorship that had been established there as a result of the recent political troubles. The writer says: The cable operators at all of the stations in Central America are surrounded by military guards, who prevent them from sending or delivering any messages which have not received the sanction of the commandant. The other day, one of these operators sent a dispatch for a friend which had not been indorsed by that officer, and narrowly escaped with his life. But for the fact that his services were absolutely necessary, no doubt he would have been hanged, or at least imprisoned. All the information that is sent to the press from Central America is prepared by these officers, and the cable operators are compelled to transmit it. I went into the cable office at La Libertad with a number of cablegrams which Mr. Hall, the United States minister at Guatemala, wanted sent to Secretary Bayard at Washington. I was stopped at the door by a bayonet, but finally succeeded in gaining admission. I was not permitted a word with the operator, except in the presence of an officer of the San Salvador army. But through his wife I sent the operator word that I had some dispatches which it was imperative should go to Washington. He said that Mr. Hall had recently sent him some messages which he had sent forward, but that the messenger who brought them imprudently revealed the fact, and the discovery nearly cost him his life. The government had absolutely prohibited him from forwarding any cablegrams to any part of the world without its sanction, and he knew that Mr. Hall's dispatches would not be approved, particularly because they were in cipher; but if he could escape detection, he would send them on, as he recognized their importance; but he refused at the same time to take messages signed by the British minister and the German minister at Guatemala, and addressed to their governments. Two gentlemen on the Pacific Mail steamer attempted to send cablegrams, one to New York, the other to Hamburg, in cipher, and the commandant refused to permit them to go, even after their contents were explained to him. At the cable office were 12 dispatches for United States Minister Hall from Secretary Bayard and others, which the operator had received on the sly, but which he had not been able to forward. He gave them to me, and I sent them to Guatemala in care of the captain of a Pacific Mail steamer.

The Mutual Union Deal.

The nine New York stock brokerage firms that were "stuck short" of Mutual Union Telegraph stock by selling 100 shares each for H. C. White, of Newark, a person they did not know, and upon narrow margins of 3 to 5 per cent., as described in our last issue, got out of their scrape very cheaply last week. Their action, when they found they had been inveigled into a very small-sized but effective corner, in appealing to the authorities of the exchange to help them out, was generally regarded as insignificant in comparison with the brilliancy displayed by the parties who made the corner.

The appeal, however, had the desired effect. The committee on stock list and on securities, and the president of the exchange, decided to suspend dealings in the stock, and the governing committee indorsed their action, thus practically striking the stock from the list. All the stock was sold at 17, and those who had 3 per cent. margin were allowed to settle at 20, and those who had 5 per cent. at 22.

This let the brokers out without loss, for which they were most devoutly thankful. Whether the precedent established in this transaction will ever cause trouble in the exchange remains to be seen. A good many brokers are of the opinion that, following it, the next time they or their customers get short of a stock, and a corner or squeeze is imminent, it will be incumbent upon the authorities of the exchange to suspend dealings in that stock and let the shorts settle for whatever margins or funds they have on hand. Mr. Woodruff, of H. S. Ives & Co., said to-day that he was the real purchaser of stock, and that he knew Mr. White and introduced him at the bank in Newark, where he kept the account he drew upon to put up margins to sell Mutual Union. The firm is not represented in the Stock Exchange.

Combined Tangent, Cosecant and Sine Galvanometer.

When the Obach galvanometer appeared a few years ago, it was acknowledged at once to be an instrument of merit and one possessed of valuable qualities. Strange to say, however, the instrument has come into but limited use, and has been superseded by more modern direct reading ones. Still, for laboratory purposes, where portability is no requisite, the instrument possesses advantages which are greatly in its favor and which are offered by no others.

We are glad to note, therefore, that Messrs. C. E. Jones & Bro., of Cincinnati, O., have undertaken the manufacture of this instrument, and embodied a number of additional features in its construction.

Fig. 1 shows the instrument in perspective, so arranged that it can be used either as a tangent, sine or cosecant galvanometer. It differs from those heretofore constructed, in that it possesses two coils instead of one, the range of the instrument being in this way greatly increased.

FIG. 1.

FIG. 2.

COMBINED TANGENT, COSECANT AND SINE GALVANOMETER.

The details of the instrument will be understood by referring to Fig. 2. As will be seen, the instrument rests upon a base A, provided with leveling screws, and graduated on its upper face. The column $E\,E\,E$ has the arms $F\,F'\,F''$ fixed to it, which support respectively the outer and inner rings, and the needle box.

The brass rings G and G' are respectively 12 inches and 6 inches in diameter, and measure 1¼ inches × ¾ inch. These rings are grooved on their periphery and filled with wire.

The arm F' carries two fixed quadrants $O\ O$, and attached to the shaft $Q\,Q$ are the verniers $P\,P$, which slide over them and mark the inclination of the coils. The needle, which is one inch long and provided with an aluminium pointer, is suspended by a fibre and protected by a glass cover. It is kept to its horizontal position and prevented from dipping by the pendulum weight M attached to it, which fulfills its purpose without interfering with the action of the needle. $S\,S\,S\,S$ are the insulated binding posts to which connection is made.

The small ring has four different coils of copper wire and one coil of German silver wire, while the large ring has one coil of copper wire and one of German silver. By inserting the plugs shown, in the corresponding holes, the current can be sent through either of these coils or all of them at will. The brass rings themselves act as coils for very powerful currents, and hence it is evident that with two coils and this diversity of winding, very small and very large currents can alike be accurately measured.

The great merit which the instrument possesses is the facility with which readings can be checked, by making them in a variety of ways. If it is desired to use the instrument as a tangent galvanometer the rings are placed vertically and, the constant of the instrument being known, the current in ampères equals the product of that quantity into the tangent of the deflection of the needle.

If the current be too powerful, so as to deflect the needle beyond the point of maximum sensitiveness, the deflection can be brought down by revolving the ring until that point is reached. The result of this operation is that even with the strongest currents the deflection of the needle is brought to zero when the coil is turned to a horizontal position, and hence large currents can be conveniently measured. If x be the angle of deflection of the needle and y the inclination of the coil, then the current equals $\frac{C \tan x}{\sin y}$ or $C \tan x \operatorname{cosec} y$, C being the constant of the instrument. By employing this method the same current can be made to give various readings, all of which must be equal to the same quantity, thus affording an easy check on the work, and if with different currents the deflection of the needle be brought to 45° (tan 45° = 1), then the current strengths will be in the direct ratio of the cosecants of the angles of inclination.

Finally, as the base A is graduated, the instrument can be used as a sine galvanometer. When so employed the coils are placed vertically and revolved on their vertical axis until the needle is brought to zero. The current passing is then equal to the constant multiplied by the sine of the angle through which the coils have been turned.

As there are two series of coils the instrument may be employed as a differential galvanometer, its arrangement making it very convenient for that purpose.

In addition to its use as a current galvanometer, the instrument may be employed as a potential galvanometer, the results obtained being equally reliable.

From the above it will be seen that the galvanometer can be used for a large variety of measurements, and in the hands of an intelligent electrician cannot fail to give good results.

Calibration of the Combination Tangent, Sine and Cosecant Galvanometer, made by C. E. Jones & Bro., Cincinnati, O.

SMALL RING.	Ohms resistance...	Constant for current in ampères...	Constant for E. M. F. in volts.....
Ring itself	Nil	2.370	
1st coil, No. 22 sc. copper	0.38	.009	
2d coil, No. 22 sc. copper	1.07		
3d coil, No. 26 sc. copper	9.45		
4th coil, No. 28 sc. copper	27.40		
5th coil, 6 oz. No. 30 German silver	2,500.00		6.25
LARGE RING.			
Ring itself	Nil	4.230	
1st coil, No. 22 copper wire	3.34		
2d coil, 1¼ lb. No. 30 German silver	7,400.00		31.61
5th coil of small ring and 2d coil of large ring combined, current passed through coils in opposite directions, or differentially	9,900.00		62.82

The above table gives the results of a calibration of the instrument for the locality of Cincinnati, Ohio.

Storage Battery or Secondary Battery.

Writing to a friend in England on the subject of secondary batteries, M. Gaston Planté says:

"I am happy to see that you are using with success some of my secondary cells for the lighting of your own house. I should tell you that you must not be discouraged if you meet with some difficulty in their use. The plates, far from deteriorating with age (like those to which artificial layers of peroxide have been applied, as in the various modifications of my couples, which have been attempted), become penetrated, under electrolytic action, more and more deeply with peroxide, which unites with them perfectly, and their capacity consequently goes on increasing without there being any danger of the plates losing their solidity. It is of importance not to leave them too long without charging them, because their resistance is increased by rest, on account of the sub-oxides or salts formed, and they afterward take much longer to charge. *You will notice that in my 'Recherches sur l'Electricité' I have not used the mischievous phrase that they 'store electricity.' On the contrary, I have said very distinctly that these cells do not directly store electricity; it is but the chemical work of the battery.*"

M. Planté, as will be seen, objects to the term "storage battery" or "accumulator," as being a mischievous phrase, and prefers the designation of secondary battery. But it may be remarked that the latter term has also been objected to on the score that the action differs in no way from that in any other battery, being, as with the others, the conversion of chemical into electrical energy.

As regards the choice of terms in this case, it may perhaps be claimed that, although objected to by some, the term "secondary battery" is more in favor in scienti

circles. The field is evidently open to the coining of a new word which shall express the nature of the battery and be in accord with the scientific principles involved in its action. Yet, as the two terms in current use give rise to no ambiguity, a new word might do more harm than good in unnecessarily complicating matters.

Dr. Werner Siemens on the Production of Electricity from Light.

BY C. E. FRITTS.

In The Electrical World for Feb. 7, I described my method of producing electricity directly from solar energy, without chemical action, and, consequently, without running expenses, and stated the progress made in practically working the invention.

The eminent physicist, Dr. Werner Siemens, has recently sent me his communication to the Berlin Academy of Sciences, showing the scientific importance of this method of generating electrical currents, and I now have the pleasure of laying before your readers a translation of it, as follows:

ON THE ELECTROMOTIVE ACTION OF ILLUMINATED SELENIUM, DISCOVERED BY MR. FRITTS, OF NEW YORK.

BY WERNER SIEMENS.

(Read by the author before the Berlin Academy of Sciences on Feb. 12, 1885.)

Mr. Ch. E. Fritts, of New York, sent me, early last year, a description of his method of constructing light-sensitive selenium plates, differing from mine in essential features, and accompanied the same by a number of the plates prepared by him. These do not consist of parallel platinum wires embedded in a thin body of selenium, like mine,* but of a thin, homogeneous sheet of selenium, which is spread upon a metal plate and, after a subsequent heating—for the conversion of the amorphous into crystalline selenium—is covered over with a fine gold leaf. Mr. Fritts has found that the green light which penetrates through the gold, by the further passage through the selenium heightens its electrical light-capacity. In fact, the sensitiveness to light (electrical conductivity) of the selenium plate between the gold leaf and the metallic base-plate is increased by the lighting of the gold leaf with direct sunlight falling perpendicularly upon it, in some of the constructions sent here, from 20 to 200 fold! The effect of illumination by diffused daylight is also greater in the Fritts cells than in mine.

One of the plates sent over to me showed absolutely no sensitiveness to light, but in place of that it has a different and most noteworthy property (*höchst merkwürdige Eigenschaft*), namely, that when a galvanometer is inserted between the gold leaf and the base-plate it shows an electrical current in the direction of the light-action through the selenium, which continues as long as the gold leaf is illuminated. I conjectured at first that this current was not lasting, but had the character of a polarization current, which continued only until the molecular modification of the selenium by the illumination was completed, and a first experiment seemed to confirm this supposition. But further trials convinced me that this idea was erroneous. In reality we have here to do with an entirely new physical phenomenon, which is scientifically of the most far-reaching importance (*die von grösster wissenschaftlicher Tragweite ist!*)

My experiments show that by the illumination of the gold leaf a difference of potential is established between it and the base-plate, which, to all appearance, is proportional to the intensity of the light, and which stands forth unchanged so long as the illumination remains constant. Obscure heat radiations do not produce electromotive force, and therefore the supposition of a thermo-electric action as the explanation of the phenomenon is excluded. Mr. Fritts holds that the light-waves penetrating the selenium are converted directly into electrical current, and therefore states as the fact the proportionality of the strength of the current to the strength of the light. They showed themselves nearly so, in the collated series of trials given in the following table:

Strength of the light in standard candles..	6.4	9.9	12.8	16.8
Strength of the current.....	18.0	30.0	40.0	48.0
Quotient.....	2.8	3.0	3.1	2.8

The strength of the light was measured with a Bunsen's photometer; that of the current by the deflections of a sensitive mirror galvanometer.

With the gold leaf exposed to the light from the southeastern portion of a cloudless sky, while the sun itself was hidden by the neighboring high buildings, the series of measurements in the following table were obtained:

Time of observation.	9:37	10:05	10:30	11:00	11:35	12:00	12:30
Deflections of the galvanometer.....	190	196	209	223	250	250	244
Time of observation.	1:00	1:30	2:00	2:30	3:00	3:30	4:00
Deflections of the galvanometer.....	245	249	228	188	173	172	108

It is seen from the foregoing that the electromotive force of the selenium plate pretty uniformly increased from 9:30 A. M. until 11:35 A M., the current then remained almost constant during two hours, and thereafter again quite uniformly decreased till 3:00 P. M.

As to the reason why some of his selenium plates become more conductive during illumination, while others produce electromotive force, Mr. Fritts has no explanation to give. He complains of the uncertainty in the preparation of the plates, of whose properties one can foresee nothing, and gives various manipulations by which one can often render unserviceable plates useful. There is yet required thorough investigation to determine upon what the electromotive light-action of many selenium plates depends. Nevertheless, the existence already of a selenium plate with the property described is a fact of the greatest scientific significance, since there is here presented to us, for the first time, the direct conversion of the energy of light into electrical energy (*eine Thatsache von grösster wissenschaftlicher Bedeutung, da uns hier zum ersten Male die directe Umwandlung der Energie des Lichtes in elektrische Energie entgegentritt*").

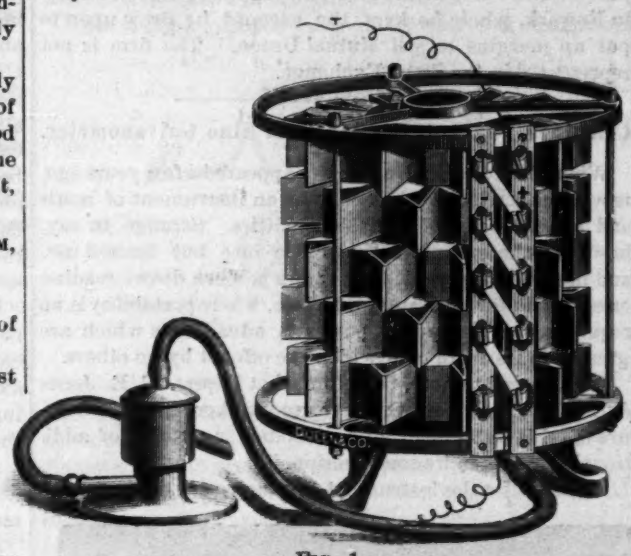


Fig. 1.

The uncertainties, etc., mentioned by Dr. Siemens as existing at the time I wrote the communication referred to (in February, 1884) have since been largely overcome. I have conclusively determined the conditions upon which the electromotive light-action depends, and with more complete and perfect apparatus for preparing the plates, I believe that I can even now effect the conversion of more than 50 per cent. of the energy of light into electrical energy. If my theory proves to be complete, when fully carried out and tested in all of its variations, we may ere long see the photo-electric plate competing with the dynamo-electric machine itself in high percentage of electrical conversion. In compactness, it is not designed to compete with it, being adapted and intended principally for what is known as "isolated" working—*i. e.*, for each building to have its own plant.

I am now able to foresee the general properties of the plates, and to give them such of the properties as I wish. I can cause a plate to show either an electromotive action or a higher conductivity when exposed to light, or to show both properties. In explanation of the slight irregularity in the action of the electromotive plate measured by Dr. Siemens, it should be stated that it was not prepared for that purpose, but was sent to him as exhibiting another and entirely different property. During the development of that property it had received some of the manipulations adapted for giving the electromotive action, and in consequence thereof it could generate a slight current upon exposure to light, although not with the uniformity of a specially prepared electromotive plate. It will also be noted that "the southeastern portion of a sky without clouds" (direct sunlight being excluded) is not a very intense source of illumination. But this fact renders the trial more satisfactory.

At the time of sending him the samples of my different constructions, I had not a very large number of the electromotive plates, and they were in almost daily use in experiments from which to deduce the philosophy of the action, so that they could not be spared, and I contented myself with pointing out that the plate in question could generate a current, sufficient, at least, to prove its possession of that property. After having my papers, data and plates under consideration for nearly a year, Dr. Siemens, than whom there is no higher or better authority, has accorded to me the honor of being the first one to produce electricity directly from light.

Fig. 2.

But I do not explain the action exactly as he supposes—that "the light-waves are converted directly into electrical current"—as is shown by the following statement concerning it, in my paper on "Selenium," read before the American Association for the Advancement of Science, at Philadelphia, Sept. 5, 1884: "The light * * * passes through the gold, and acts upon its junction with the selenium, developing an electromotive force which results in a current," when the circuit is completed. "The current thus produced is radiant energy converted into electrical energy directly and without chemical action." The final result is the same, of course, but the *rationale* is different.

In conclusion, I would say that however great the scientific importance of this discovery may be, its practical value will be no less obvious when we reflect that the supply of solar energy is both without limit and without cost, and that it will continue to pour down upon us for countless ages after all the coal deposits of the earth have been exhausted and forgotten.

*Monatsbericht der Berl. Akad. d. W. vom 13. Mai 1875 und 7. Juni 1877.

Thermo-Electric Batteries at the Philadelphia Exhibition.

In the chemical and physical laboratory, where electrolytic determinations are made on a small scale, there is perhaps no more convenient source of electricity than the thermo-electric battery. It requires no care whatever, and the mere lighting of a Bunsen burner puts the battery in activity, and its work ceases as soon as the gas is turned off.

At the exhibition, two forms of thermo batteries were exhibited by Messrs. J. W. Queen & Co., one of the Clamond and one of the Nöe-Rebicek pattern.

The first of these, shown in Fig. 1, consisted of pairs of iron and an alloy of bismuth and antimony, arranged in rings. There were 14 rings of 11 pairs each, 154 pairs in all. The examining committee found the battery to give an electromotive force of 3.02 volts, and to have while hot an internal resistance of 2.2 ohms.

The following is the statement of the maker of the Clamond batteries:

No. of elements.	E. M. F., in volts.	Internal resistance, ohms.	Gas per hour required, litres.
50	1.8	0.3	350
100	3.6	0.6	450
150	5.4	2.0	350 (550 ?)

The Nöe-Rebicek, a more recent battery, gave very good results. In this thermo pile there were 20 pairs of elements, consisting of German silver and an alloy of zinc and antimony. As shown in Fig. 2, the elements are arranged horizontally and radially at the top. The flame itself does not come into direct contact with the joints, but the heat is led to them by a short, thick copper wire, which is exposed to the flame. The central disc, against which the flame strikes, also imparts its heat to these copper conductors, which point directly toward it and surround its entire circumference. The elements rest on a stiff insulating ring, which carries, in addition, the vertical cylinders shown in the cut. The latter consists of rolls of sheet copper, and their object is to conduct the heat away from the elements and to convey it to the surrounding atmosphere. With this arrangement all the short wires, and, consequently, the elements are heated by a single Bunsen flame in an economical manner.

Of the two batteries of this pattern tested by the committee, the larger had an electromotive force of 1.94 volts, or nearly one-tenth of a volt per pair. The smaller one gave 1.73 volts. The internal resistance of the larger was .5 ohm, and the smaller, .8 ohm. This is a very good result, and, as the committee state, the Nöe-Rebicek battery has the highest electromotive force of any thermo battery that has been made on a commercial scale, and seems a long step away from the ordinary bismuth-antimony pile, and toward a thermo pile that may be used as a substitute for the common galvanic battery. They are made of 20 elements each for a single pile, or as the substitute for a single battery cell, and any number of them can be combined either in series or in parallel to give corresponding effects.

The Chief Signal Officer Reprimanded.

The court-martial proceedings in the case of Gen. William B. Hazen were made public at Washington on the 17th. The sentence is a reprimand, which is made by the President as follows:

"The proceedings, findings, and sentence in the case of Brig.-Gen. William B. Hazen, Chief Signal Officer, United States Army, are hereby approved. In giving effect to the sentence of the court-martial it is to be observed that the more exalted the rank held by an officer of the army the greater is the responsibility resting upon him to afford through his own subordination to his superior officers an example for all others who may be of inferior rank in the service. To an officer of fine sensibilities, the mere fact of being brought to trial before a court-martial must be in itself a mortification and punishment. In the foregoing case the accused, whose high rank and long experience in the service should have inspired him with a full realization of that respect for constituted authority which is essential to military discipline, has been adjudged guilty of indulging in unwarranted and captious criticism of his superior officer, the Secretary of War, thereby setting a pernicious example, subversive of discipline and the interests of the service. Subordination is necessarily the primal

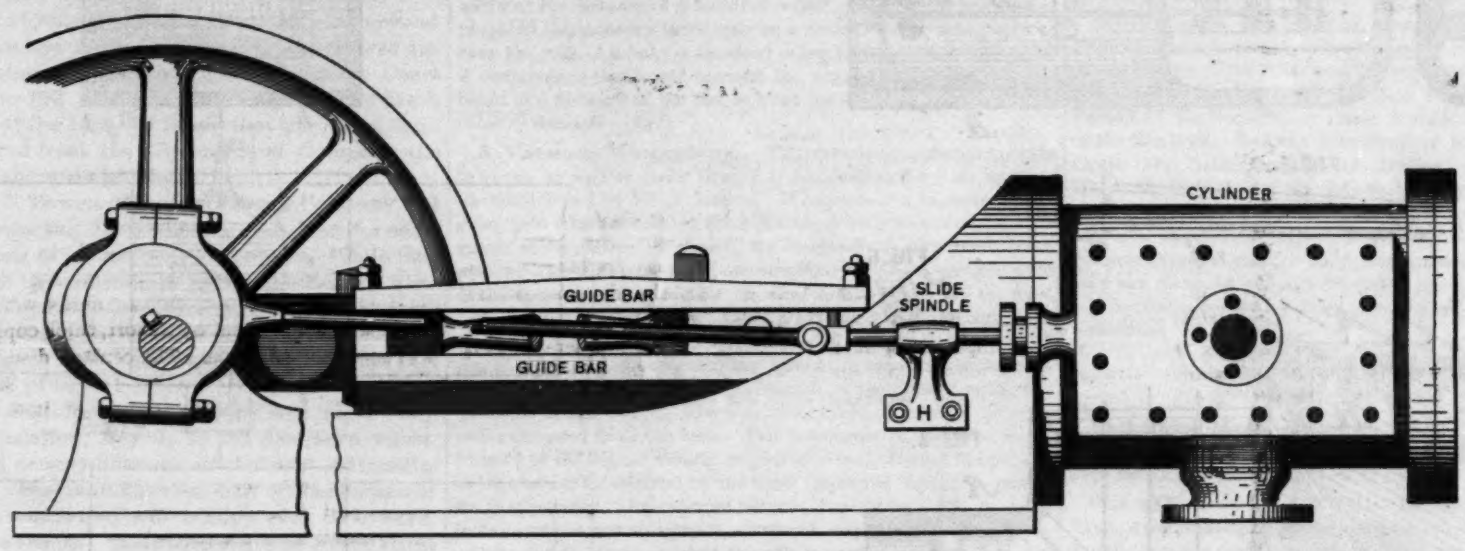
duty of a soldier, whatever his grade may be. In losing sight of this principle the accused has brought upon himself the condemnation of his brother officers who examined the charges against him, and seriously impaired his own honorable record of previous conduct. It is to be hoped that this lesson will not be forgotten. Gen. Hazen will be released from arrest and assume the duties of his office."

The charge on which Gen. Hazen was tried was conduct prejudicial to good order and military discipline. The court found him "guilty," and recommended that he "be censured in orders by the reviewing authority."

High-Speed Engines.

BY JOSHUA ROSE, M. E.

The advent of the high-speed engine not only brought into the foreground some new engineering problems, but it also disturbed many that were considered entirely settled. The common slide-valve gear, with its inability to cut off earlier than three-quarter stroke without distorting the points of cut-off, the lead or the compression, had to go, because, aside from the above defects, its great amount of travel and slow admission rendered it unfit for regulation by the governor direct, or, in other words, independent of throttling and wire drawing. In its place we have numerous forms of valves which are multiported with a short travel, and having the amount of travel and therefore the point of cut-off regulated by the governor, or what may be more properly called the regulator, since very few of the really high-speed engines employ the Watt and fly-ball governor, but depend upon the centrifugal force of weights or weighted levers connected to the fly-wheel or to an independent pulley or wheel. With such a regulator it is imperative to confine duty within limits far less than that required by the ordinary slide-valve, which answers well enough when used as in the locomotive, often referred to as the primary high-speed engine.



BED OF HIGH-SPEED ENGINE.

There are problems, however, in the high-speed engine, of the greatest importance, that are not considered in the locomotive, and among these is the accurate balancing of parts to insure absolutely quiet running. In the American locomotive flexibility of the frame is actually commended, whereas in the high-speed stationary engine a rigid frame is of prime necessity. The overhanging cylinder, such as in the accompanying illustration, is finding more and more favor among engineers, and from current trade literature it would appear that more than one person claims its invention. Thus we have heard it called the Allen, the Porter-Allen and the Tangye bed. Our earliest recollection of it goes back to 1867, when we believe that the engine sent to England for competitive trial with English engines had this style of bed. It is true that the English engineers have employed it more than the American, but still we think it is as distinctively American in its origin as the Corliss frame. The high-speed engine has also greatly improved the quality of workmanship, because a class of work that will answer very well for the old long-stroke engine with a piston speed of 250 feet per minute, will not answer for an engine whose stroke only equals or is not more than one and one-half times the cylinder bore, and whose piston speed is from 500 to 800 feet per minute.

The necessities of electric lighting have beyond question been a great factor in the development of the high-speed engine, but nevertheless high speed was bound to become general, if for no other reasons than those of the smaller space occupied by the engine and the economy of fuel consumption.

Ribbon Wire.

A firm in Glasgow, Scotland, is now manufacturing ribbon wire for electric purposes. It is nearly rectangular in section, and thus can be wound into a smaller space than round wire, while its greater flexibility renders it far more easy to manipulate. It is marked with the same numbers as the corresponding sizes of round wire, and is delivered on wooden bobbins.

The Bell Telephone Inquiry.

The hearing before the Massachusetts legislative committee on mercantile affairs, on the petition of certain parties for a more complete supervision of telephone companies, is still in progress. We give below the evidence of Mr. Theodore N. Vail, on April 20, as reported in the New England papers:

Mr. Theodore N. Vail, general manager of the American Bell company, said he was previously manager of the National Bell company, which was a company doing business from which was evolved the American Bell. His position did not make him a director of the American Bell, but he had been one in nearly all of the licensed companies in which the American Bell had an interest. Was a director in the National Bell of Maine when started. Subsequently the stock of the company was transferred to Ingham, Glidden, and others of the same party. Held for himself about one-tenth of the Maine company, which he purchased for cash, and received dividends for himself. For the quarter ending March 31, 1882, it was possible that he received a quarterly dividend of 2½ per cent., though he thought it was 1½ per cent. Had no interest in the Ingham pool except to sell to them what stock he held, with the exception of ten shares, which he continued to hold. Considered that he got a fair price for the stock which he sold, and that the Maine company paid well. There was held no interest in the Maine company by the Bell after the transfer to the Ingham pool previous to consolidation. The officers of the American Bell were aware of the transfer. When the American Bell leased to the Maine company the rental for telephones was $6 net a year per hand telephone, and $12 with the transmitter. That charge was not increased at the time of reconsolidation. The charge of the American Bell to the New England is now $7 for each telephone instrument; for a hand telephone and transmitter, $14. From the time the Maine passed into the Ingham syndicate it has paid good dividends. When the reconsolidation was effected in October, 1883, $675,000, or 33¾ per cent. of the Maine stock, was transferred to the American Bell. Had no reason to believe that dividends made by the American Bell of Maine were unfairly earned. Mr. Vail said he held a nominal directorship in many of the licensed companies to protect the interests of the American Bell. The appearance in the trial balance of the National Bell of Maine of, upward of $1,000,000, charged to construction account for one month, Mr. Vail believed to be a proper charge, which was made on account of the acquisition of extensive additional territory. The manner of keeping telephone accounts originally included in the construction account the full cost of establishment, not simply the erection of lines. Previous to that, while the company was confined to Maine, there was charged to the construction account $105,000 in one month, which Mr. Vail could not say was or was not a fair charge. Being questioned as to the cost per mile of construction of a telephone line, it varied exceedingly. Mr. Vail said he was a director in the Boston & Northern at the time of the reconsolidation. The first rate charged the Northern was $6, subsequently $7, which is the uniform rate charged everywhere by the American. After the Boston & Northern passed into the Ingham syndicate it paid good dividends, and Mr. Vail presumed that dividends earned were fairly made.

The policy of the American Bell has been to encourage payment of dividends by local companies with a view to getting local influence and capital interested in telephones, but the Bell has never encouraged the payment of dividends except when earned. Mr. Vail never had any connection with the Erie company. The licensed companies under the Bell in Massachusetts are the New England and Southern Massachusetts companies. The American Bell own a controlling interest in the New England company. Witness was president of the New England, in the board of directors of which there is a majority of Bell men. The New England company is now expending considerable money in building new lines, enlarging trunk lines, cable work and extra-territorial lines. They are using copper and iron wires. The New England are building more extensive lines than formerly, and are using more copper wire than heretofore. There is no special contract whereby the American Bell company may use a wire of the New England company; but they do use them, and if the New England have a copper or long-distance wire across the State, the American Bell may use it. The cost of putting up a single copper wire is from $200 to $400 a mile. There are three sizes of wire now used. It has been demonstrated that copper wire is essential for long-distance telephoning. The proportion of the amount now being expended by the New England company for repairs is about one-third. The American Bell have reserved the right of putting a single wire upon the sub-companies' poles, but we do not compel sub-companies to put up poles suitable for our business. Mr. Vail said, in answer to whether the dividends purporting to be earned by the Maine and sub-companies were properly earned, that there had been a difference of opinion about that, and that the discussion had not resulted in a concurrence of opinion. It had always been the policy of the American Bell to give the construction account a wide margin. There was $4,000,000 stock received by the Bell as franchise from the New England. Next September they are to have dividends upon $1,320,000, and it will be September, 1891, before it can draw dividends upon the full amount of the stock. Asked if it is not better for the American Bell to make the extension of the New England now, so that in 1891 that company may be in better condition to pay dividends then, Mr. Vail said he did not look at it in that way. It was a part of the contract that the New England should pay for the construction. The Bell would rather have dividends paid now, while going along. If the New England would put in the money for the new constructions, then the dividends could be paid. The extensions were made by the unanimous consent of the board of directors. The board had concluded that it would be impossible to stop construction. If construction should be stopped the New England could pay dividends, as it is doing a legitimate business. It could not be said that so long as this policy is continued there will be no dividends until the extension is completed. Business is improving, and, while Mr. Vail didn't say when a dividend could be paid, he believed that the time was not far off. The subscribers in Boston, he said, are paying no more, all things considered, than subscribers in other cities. Mr. Vail said the cost of the Blake transmitter and hand telephone was between $5 and $6, ready for shipment. The transmitters are made by the Western Electric Company, in which the Bell has a controlling interest, and the actual cost is about the same as the Bell pays for it. Upon it they get from the New England an annual return of $14, and for that matter, from all other licensed companies. By contract the New England company must use the Bell company's instruments, but the Bell company has not by contract fixed the rentals which shall be charged. The Bell has a contract with the Western Union Telegraph Company by which the former receives 15 per cent. of the charge for a dispatch sent to the telegraph office over the telephone wires. Mr. Vail did not think that 100 per cent. of the cost of the instrument annually would be sufficient to pay the Bell company a fair dividend, as the company's legal, experimental, official, and patent-buying expenses were very great. He said, as a business man, taking into consideration the patent risk and the cost of establishing the telephone lines, that he did not think $14 a year an extortionate price to charge upon an instrument costing $5.

Mr. Vail said the amount of money expended by the Bell company has been about $6,000,000, and its whole rights in the original patents will expire in 1894. The first dividend paid by the company was in 1880 or 1881. It took a long time to develop and introduce the telephone, requiring a vast expenditure of money and the exercise of great business talent. When he said that $14 a year was not an excessive charge, he took into consideration the fact that at the end of eight years the public would have just as much right to the telephone as the company. He also considered the fact that when large sums of money were invested in the Bell company they rested for their security upon

the decisions of the court. The Bell was in contest with the Drawbaugh four years, and the expense of this one suit has been nearly half a million dollars, and it is still undetermined except so far as the decision of the Circuit Court goes. Then there are other great risks. Last winter a storm did damage to the New England Company's lines which cost $25,000 to repair, and in one night a storm in New York City cost the company $100,000. Mr. Vail said he had found by actual experience that a telephone system has to be rebuilt every three or four years. The Bell company tried to give to Boston the same rates as to other large cities, and he thought that if there was any difference it was in favor of Boston. The proposition of consolidating the various companies was discussed during a whole year before it went into effect, by the stockholders and by the directors.

Mr. Vail said that one-half of the 15 per cent. paid by the telegraph company was paid over to the sub-companies. The city of Boston allows its subscribers free connection with 20 suburban exchanges. There are 4,385 subscribers in Boston, the largest in the country except New York. The Philadelphia exchange has 2,200 subscribers. The charge there is $100 for house and $120 for office. In Boston it is $72 and $100 respectively. The value of a telephone consists largely in the number of persons with whom the user can be placed in connection, and there is no city in the country where a subscriber has connections with so large a number of persons for so small a sum as in Boston.

Asked if the expense of storms has fallen upon the local companies, Mr. Vail said it had. Asked if the company did not own many patents of importance to the telephone business which will not expire in 1894, but will run for many years after, Mr. Vail said it did.

Underground Conduits.*

MAGNER'S SYSTEM.

This system consists of a conduit constructed of cast iron, terra cotta, etc., having a longitudinal slot A' at its top for the introduction of wires or cables. This slot is beveled and made tight by bolts and clamps bearing on the inside of the conduit (see Fig. 5). The joint is further secured by suitable packing.

The wires or cables are supported on insulated rollers, which revolve freely on a series of horizontal shafts, suitably supported and arranged one over the other. These rollers may be formed in one piece, or may consist of a number of independent rollers separated by washers. The distance apart of the rollers, both horizontally and vertically, is such as to prevent contact between the wires or cables when strained up.

The inventor claims that his system provides a conduit applicable to all descriptions of wire or cable, which is easy of access for the insertion or removal of any wire or cable, and in which the wires are kept taut.

The inventor did not submit any plan for manholes, or any arrangement for providing house-to-house supply, nor does he claim any method of obviating the effects of induction. He proposes to lay down well insulated wires, as the conduit would be necessarily more or less damp.

After the conduit has been laid and filled with wire, any alteration to the system would require that the street should be opened from end to end.

PENNOCK'S SYSTEM.

The material used in constructing this conduit consists of hemlock wood, copper wire, various compounds and insulations, the nature of which the inventor did not disclose.

The wood is exposed to a solution for several hours, at the temperature of boiling water. The composition being easily distributed through the mass of soft wood, incrusts the cells with a compound which makes the wood absolutely moisture and decay proof. The carpenters now take the wood (which has become dry and hard) and make a hollow box—the core of the conduit—which is filled in with insulated telephone wires, arranged according to a plan not disclosed. When the core is filled, insulating material is again poured upon the wires, filling in the interstices, making a dry, solid mass. The top is now cemented on. The finished core now receives a second coating of the waterproof compound. (Fig. 1 shows the completed core.) Around this core are now built the receptacles for the insulated telegraph conductors (as shown in Fig. 2). There are two inches of insulating impermeable compound between the telephone and telegraph circuits, 6 inches between all sides, ½ inch all around.

The finished core is now set in the outer shell of the conduit, which is also made of the prepared wood, 1 inch thick. A moistening compound is now run in around the core and the top covered with a plank of the same prepared wood, pressing into the compound, making two inches of solid, impermeable matter between the core and the casing, three inches between the core and the earth, five inches between the telephone and the earth. The sections are all prepared at the factory before being taken on the ground. They are run into sleeves every 20 feet; 20 loops are run out on each side of the sleeve and covered with a waterproof cap, so that the wires are at all times accessible. The wires are connected through the sleeve with a patent, hard paper, double connector.

The electric light conduit is made in a similar manner, but the wires are widely separated, and different materials are used in insulating and for waterproofing.

The advantages claimed for this system are: (1) It is fireproof. (2) It is waterproof, it will not decay. (3) It is a perfect insulator. (4) No leakage between telephone and telegraph wires. (5) The arrangement of the conductors in the lanes to divert induction, etc. (6) The wires will not corrode. (7) The wires cannot break, no pulling of cables through tubes, no abrading, no strain. (8) Insulated wires can be tapped and conveyed into each dwelling without disturbing the main conduit. (9) It is cheaper than a pole line.

Price per mile for	100	telephone	wires,	delivered	on	ground.	$2,500
" " " "	1,000	"	"	"	"	"	9,750
" " " "	100	telegraph	"	"	"	"	2,750
" " " "	1,000	"	"	"	"	"	12,750

COMMENTS BY THE EXAMINERS.

The whole success of this system would depend on the nature of the insulating material and the chemical preparation of the wood, etc. Without trial, over an extended period of time, it would not be possible to test this conduit for endurance and the other points claimed by the inventor.

The Sprague Motor.

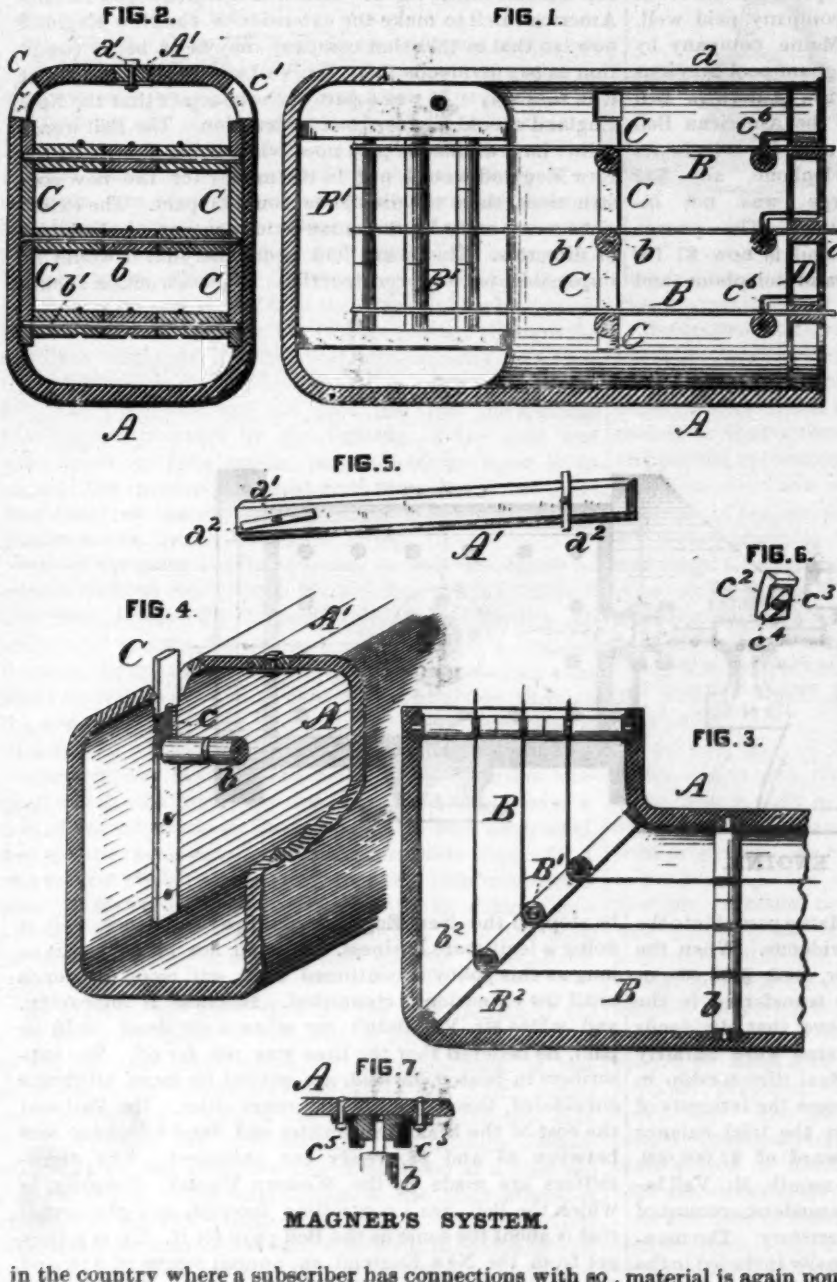
Great interest has been felt in the Sprague motor, to which general attention was first called in the fall of 1884, at the Philadelphia Exhibition. Mr. Sprague has now been granted five patents on the machine, enumerated on page 170. There are several points on which his claims to originality and efficiency are based. A leading feature is that the field magnet has sectional coils and other coils in a shunt around a variable number of the sections and independent of the armature circuit, in combination with means for varying the number of sections around which said independent coils are shunted. The field coils are wound sectionally in layers, the coils of each section of a series being wound upon the whole length of the core, or of that portion of the core which is inclosed by the series, and the sections are connected so as to form a continuous and unbroken series of coils. Connections from the bights of these coils are brought to suitable contact blocks, on which travel arms which form the inlet and exit terminals of the supplying circuit.

Other claims are as follows:

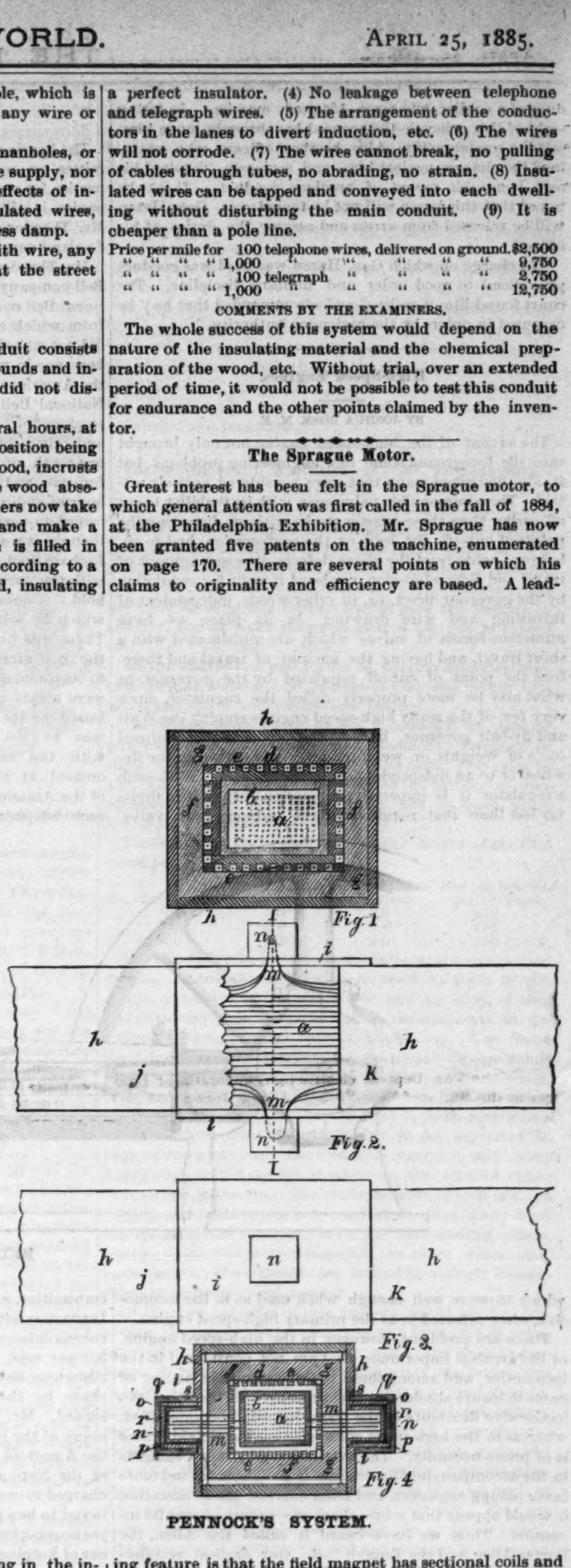
A compound wound electro dynamic motor or dynamo-electric generator having its two field coils proportioned so that the number of turns in the shunt coil bears the same relation to the number in the series coil as the resistance of the shunt coil bears to the sum of the resistances of the series coil and the armature.

A compound wound electro dynamic motor or dynamo-electric generator having its two field coils proportioned, so that the number of turns in the shunt coil bears the same ratio to the number in the series coil as the sum of the resistances of the shunt coil and the armature bears to the resistance of the armature.

The method of regulation for the brushes consists in



MAGNER'S SYSTEM.



PENNOCK'S SYSTEM.

* Report of the Board of Examiners, Section 18, Underground Conduits, International Exhibition, Philadelphia.

automatically increasing the negative lead of the brushes simultaneously with an increase of the armature current, and vice versa, and decreasing automatically the negative lead simultaneously with an increase of field-magnet strength, and vice versa.

WESTERN NOTES.

THE ELECTRICAL WORLD BRANCH OFFICE,
CHICAGO, April 22, 1885.

Efforts are being made to extend the Niobrara (Nebraska) telephone line to Creighton.

Col. R. C. Clowry has been elected to fill the vacancy caused in the presidency of the Central Union Telephone Company by the death of General Stager.

The Milwaukee Electric Manufacturing Company now has offices open for business at Milwaukee, Chicago, Detroit, New York, St. Louis, Cincinnati and Minneapolis.

Mr. T. Torrey, of the Utica Fire Alarm Telegraph Company, was a welcome visitor at this office last week. Mr. Torrey is west on a business trip, and left for St. Paul, Minn., the 17th inst.

The city of Flint, Michigan, has just added to its electric light plant, and now has 100 Van Depoele lights burning; 36 of the 100 are on towers. The local papers say that the citizens of Flint are very enthusiastic over the electric illuminants.

According to a circular received from Lynch & Banta, stock brokers, 144 La Salle street, Chicago, the stock of the Central Union Telephone Company has been regularly listed on the Chicago Stock Exchange. I believe that this stock was listed once before, but afterward withdrawn.

The conversion of the Ft. Wayne Jenney Electric Light Company into the Jenney Electric Light Company, with future headquarters at Indianapolis, Ind., seems likely to prove a very important step in the progress of this company, as the names representing the new management are a guarantee that the business will from now on be pushed for all there is in it.

The suit of the Chicago Sectional Electric Underground Company against the Postal Telegraph Company was dismissed by agreement in the United States Circuit Court yesterday. The bill was given at length in THE ELECTRICAL WORLD of the 11th. It is said that the Postal Company has acquired from the Underground Company the right to use all the wires laid by it.

The Hon. Geo. S. Bowen, of the Van Depoele Company, has just returned from the East, where he has been for some time in the interest of his company's apparatus. While East Mr. Bowen was instrumental in having the Eastern Electric Company organized at Elizabeth, New Jersey, to handle the Van Depoele electric light apparatus and motors in the States of New York and New Jersey and part of Pennsylvania.

The Western Edison Light Company will move from their present location, May 1, to 185 Dearborn street where they will occupy quarters in the new Adams Express Building. They will have one-half of the basement of the building, which they will occupy with their work, testing and store rooms. Their offices will be on the street floor, and much more convenient in every way than at present. Three hundred Edison lamps are to go into the building and a 9½ × 12 inch Armington & Sims engine will be used. The old Edison plant, 250 lights, will be continued from the store of E. B. Millar, 41 Wabash avenue.

Señor G. Bûlle, Secretary Compania el Progresso, of Hermosillo, Mexico, was in Chicago last week. Señor Bûlle's company has the exclusive franchise for lighting the city of Hermosillo by electricity for fifty years, also for conducting the public baths and furnishing ice for general consumption. While in Chicago Señor Bûlle purchased an electric light plant of the Van Depoele Company, comprising 30 arc and 200 incandescent lights. This plant will be used for illuminating the capitol buildings (Hermosillo being the capital of the State of Sonora) and the gardens in front of same. One of the New York Safety Steam Power Company's engines will be used, Señor Bûlle having purchased an engine from Manager Hammett while here. This plant is considered only a starter, as it is the intention of Señor Bûlle's company to do a general electric lighting business throughout the city of Hermosillo.

THE TELEGRAPH.

Antipodal Antipathies.—The telegraph and telephone wires at Melbourne, Australia, are being put underground, because of the objection offered to their presence overhead.

Communication with Moving Trains.—The Edison system of railway induction telegraphs heretofore mentioned, utilizes the metallic covering of the cars and requires the wire that carries the inducing current to be brought near the roof at various points along the track.

Receiver for the American Rapid.—On Saturday last, the 18th inst., at Hartford, Conn., the petition of the Boston Trust and Safe Deposit Company for the appointment of a receiver for the American Rapid Telegraph Company, was heard in the U. S. District Court. The judge decided to appoint a receiver, but gave the parties in interest until Tuesday, the 21st inst., to file nominations for the receivership and the form defining the power to be given to the receiver. The bond of the latter was fixed at $50,000. Col. Robert G. Ingersoll appeared for Edward S. Stokes, who has an interest of $383,000, and Roscoe Conkling for the American Rapid.

An Old Electrician's Will.—Norman Williams and George Sturges have been appointed executors of the will of the late General Anson Stager. Deceased left three daughters. The appraisers have valued the estate at $850,000, viz.: Real estate to the amount of $125,000, and personal property amounting to $725,000. The estate is to be equally divided. The two oldest daughters, Louise Stager-Gorton and Annie Stager-Hickox, are to receive half of their shares at once and the other half on reaching the age of 40. The youngest child, Ellen Sprague Stager, is to receive one-fourth of her share on becoming 21 years old, another fourth on reaching the age of 30 and the last half on becoming 40.

Tied Up in Bagging.—The 13 "ticker" instruments of the Commercial Telegram Company in the New York Stock Exchange were covered over with white cotton bagging, securely tied down, on the 20th, by order of the Committee of Arrangements. This action was taken, it was explained, in consequence of the failure of the company to give the Stock Exchange a bond securing the latter organization from loss or injury by being involved in the litigation between the rival stock quotation companies. The Stock Exchange managers were not quite certain regarding their legal rights in the premises, and therefore determined to stop using the Commercial Company's instruments until the existing injunction is removed.

Allowed to Sell the Bonds.—As security for the claims had by him against the Bankers & Merchants' Telegraph Company, Mr. Austin G. Day held mortgage bonds of the company for $334,000, par value. Having obtained judgments for $48,000 against the company in Illinois, Mr. Day assigned them and the bonds to Edward S. Stokes. An injunction was granted by Judge Donohue about two months ago restraining Stokes from enforcing the judgments or disposing of the collateral. On the ground that the bonds have a market value of only 5 per cent. of their par value and are continually depreciating, thus lessening the security for his judgments, Stokes obtained from Judge Barrett, in Supreme Court, Chambers, in April, an order permitting him to sell them.

THE TELEPHONE.

The Inventor Conceals Himself.—A new telephone instrument has been invented by which the crying of a baby may be heard at the distance of a hundred miles. Of the fifty millions of people in this country there may be a dozen or two who yearn to hear the yells of a baby a hundred miles distant, but we doubt it. A contrivance that would prevent the crying of a baby being heard at a distance of ten feet is what the sleepless parents of this country demand.—*Ex.*

A Vacuum Microphone.—That metal microphones operate in vacuo, as well as under liquids, is demonstrated by an apparatus constructed by Mr. J. Munro. It consists of a vacuum bulb of glass, into which are sealed three platinum wires supporting a wire-gauze microphone. Between the electrodes is stretched a small plate of iron-wire gauze, and one electrode carries a movable plate of the same material, smaller in size, and leaning on the fixed plate behind. The current from a battery is sent through these two plates in circuit with a telephone, and the ticking of a watch placed on the base-board, or other sounds, is rendered in the telephone. The peculiar effect noticeable is the clear, ringing distinctness of the sound, which is observable as soon as the air is well exhausted from the bulb. The apparatus in question is exhausted to the degree usually employed in incandescent lamps, and as high as can be effected by the most improved mercury pumps for that purpose. An external magnet, having one pole brought in front of the movable gauze, serves to adjust the microphone, and the sound is loudest when the pole is nearest without actually pulling the movable gauze so far from the fixed one as to break the circuit of the current. Another form of vacuum microphone, in which loose iron grains take the place of the gauze and lie between two platinum electrodes, has also been constructed by Mr. Munro.

Studying Telephone Currents.—Prof. Chas. R. Cross described last week, before the Institute of Technology, at Boston, some new apparatus for the study of telephone currents. His first step was to describe at length the method in which currents are formed in the wires of the telephone circuit, and how the changes in their intensity are made to reproduce vibrations caused by the voice. Any ordinary one-direction current, he showed, was easily measurable by the galvanometer. But the telephone current sometimes ran in one direction, sometimes in another, the alternations being very rapid. To obtain indications of such currents as these, a special galvanometer had to be used. It was formed of one coil of wire inserted within another, the centre coil being kept in position by a torsion suspender. A current sent through both these coils at the same time tended to bring them both into a position of parallelism toward each other. When reversed, the current was reversed in both coils at the same time, the effect upon the centre coil being thus not intermittent, but continuous, and in the same direction, according to the strength of the current, no matter how often it might be reversed. The centre coil carried a mirror reflecting a beam of light upon the wall, and as the tendency was toward parallelism or away from it, the spot of light was moved as on a scale. This experiment was tried with great success. When the loud-speaking transmitter was used, the deflection was very marked; the Bell telephone gave results much inferior. It ought to be mentioned that the effects were only produced with single vowels, such as a, o, u and y. Judging from the results thus far obtained, Professor Cross was enabled to declare the telephone current to have an enormously greater strength than it has hitherto been supposed to possess.

THE ELECTRIC LIGHT.

New Bedford, Mass., is to have 25 arc lights instead of 21 as heretofore.

Indianapolis, Ind.—The Jenney Electric Company, newly formed under the auspices of the Nordyke & Marmon Company, is rapidly getting into shape for work, and will have a large local plant in operation within five or six weeks.

Mr. Henry M. Byllesby, Room 81, 115 Broadway, this city, has taken up the business of contracting to install the electric light wherever wanted, and is ready to send in proposals for plants of all the leading systems and of all sizes. Mr. Byllesby's experience is an eminent qualification for this work.

The Electric Light in Germany.—Although the Edison Company have now obtained a favorable decision against the Swan Company in respect to the use of the filament lamp, they are not, says the English *Electrician*, without competition in Germany. In a case of interference between Edison and Bernstein the hollow carbon of Bernstein was declared independent of the Edison claim, and Bernstein lamps are now sold in Germany as usual irrespective of any claims of the Edison Company. We understand that the Bernstein Electric Lamp Company are about to commence manufacturing in England.

Graceful Submission.—The Citizens' Gas Light Company, says the Jacksonville (Fla.) *Times-Union*, are now perfecting arrangements for putting in a plant for electric lights at their works on Pine street. To a reporter yesterday afternoon Mr. Hubbard said that he had had the subject under consideration for a year or more, but he did not finally decide to put the plant in until within the past few days. He said he would employ the latest and most perfect system known, and be prepared not only to supply arc lights, but to light residences with the incandescent light at a very small cost either to the company or its patrons. From his conversation the reporter inferred that he would make a bid for lighting the streets by electricity, and if a contract was awarded him the new plant would be put in immediately; and if not, he would put it in at his leisure during the latter part of spring and summer, so as to have it in full operation early next fall.

APPLICATIONS OF POWER.

Electricity in Store Window Decoration.—In a store window at the corner of Thirteenth and Chestnut streets, Philadelphia, there is presented one of the prettiest effects imaginable. The scene is the playground at Lemon Hill, Fairmount Park, in that city, and there are flying horses, swings and all the other accessories of that Paradise for the little ones in full motion. Little manikins sit in swings and bestride the horses, much to the enjoyment of the real children, who gaze from the pavement and enjoy the fun. The swing and horses are run by electricity, and this is the first attempt of the kind made to apply that motive power to the art of window decoration.

Millionaires Looking at Motors.—A distinguished party consisting of Jay Gould, Sidney Dillon, Russell Sage, President Samuel Sloan, of the Delaware, Lackawanna & Western Railway; Frederick F. Thompson, of the First National Bank; Henry V. Parsell, of the North River Bank; President Edward H. Johnson, of the Electrical Railway Company of the United States; Mr. Cyrus W. Field, Hon. David Dudley Field and Rev. Dr. Henry M. Field visited Mr. Edison, at Bergmann & Co's., corner of Avenue B and 17th street, this city, on the 16th inst., and inspected the electric motors intended for trial on the Second Avenue Elevated road. They were greatly pleased with what they saw there, as well as with many ingenious electrical devices and conveniences which they saw afterward at Mr. Johnson's residence.

MISCELLANEOUS NOTES.

Extremes Meet.—Icehouses at Indianapolis, Ind., were struck by lightning on April 18 and burned down, with a loss of over $20,000.

For the Deaf and Blind.—Mr. George Stewart, of New York, a manufacturer of fine machinery and the inventor of a flexible arm for mowing machines, has now designed a telegraph instrument for the use of blind or deaf people, in which the work is done by means of the sense of touch, the vibrations being read or interpreted by the fingers.

Libel Suit.—The Commercial Telegram Company commenced an action in the New York Superior Court, on April 16, against the Gold & Stock Telegraph Company, claiming $50,000 damages for an alleged libel contained in a circular issued by the defendants with the object of persuading brokers and others throughout the city not to use the instruments of the Commercial Telegram Company.

An Interesting Relic.—The New Haven (Conn.) Colony Historical Society has just come into possession of a piece of the cord which was attached to the famous kite which Benjamin Franklin flew in 1750, and through which he brought the electricity from the clouds. It is apparently linen twist, through which passed a fine copper wire. Its authenticity is vouched for It has been in possession of the donor for 50 years.

Gray's Harmonic System.—At the meeting of the Electricity Society, at Buffalo, N. Y., on April 17, Mr. Harvey D. Reynolds delivered a very interesting lecture on Gray's harmonic system of telegraphy, supplementing his explanations with diagrams and the operation of a complete set of apparatus. Mr. Reynolds is the local manager of the Postal Telegraph Company, which has been using the system for a long time with success.

A Negro Superstition.—Two summers ago lightning struck a turpentine camp in Chesterfield County, and killed two and wounded three colored men in a tent containing seven men One of those severely hurt was Daniel Brown. He met his death on Saturday night by drowning while crossing Peedee River. He had caught some fish and was returning, when the boat sank. The negroes say Daniel could not swim, having been struck by lightning. They firmly believe if a man is struck by lightning he will never be able to swim again.—*Charleston (S. C.) News.*

STOCK QUOTATIONS.

Telegraph, telephone and electric light quotations on the New York Stock Exchange, Boston Exchange and elsewhere are as follows:

Telegraph.—Am. Cable, b 55⅝, a 56½; Am. Dist. Tel., b 12, a 25; B. & M., b 2, a 3; Postal sixes, b 17, a 19; Western Union, b 58⅛, a 58¼.

Telephone.—Am. Bell, b 208, a 209; Erie, b 20; New England, b 27, a 27½; Mexican, b 1⅝; Tropical, b 1¼.

Electric Light.—No new quotations.

BUSINESS NOTICES.

Anti-Magnetic Shields for Watches.—These shields, made by Giles Brothers & Co., State and Washington streets, Chicago, are an efficient protection to the works of watches from magnetism, as many testimonials in their possession show. This firm also demagnetize watches which are already affected.

Experimental Apparatus.—Mr. Hugo Kayser, 12 Elm street, New York, has had considerable experience as a manufacturer of electrical instruments and experimental apparatus, as well as light machinery for companies and patentees. He makes a specialty of models, and always takes the greatest pains to suit and assist his patrons.

The Electric Light Wire Cutter.—The firm of E. S. Lee & Co., 164 West Main street, Rochester, N. Y., are manufacturing a tool for fire departments, to be used in cutting down and removing electric light, telegraph and telephone wires in cases of necessity. It is made something after the principle of their well-known tree trimming tools, which have already been described and illustrated in THE ELECTRICAL WORLD. It is strong and effective, and easily cuts iron or steel telegraph wire, or the covered copper electric wires; it has a long handle, thus enabling the firemen to cut down the wires without danger from the falling ends.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

PATENTS DATED APRIL 7, 1885.

Means for Adjusting Armature Springs; James F. Gilliland, Indianapolis, Ind..... 315,017

Consists of the combination with the armature spring *C* of an electro-magnet *A*, of an adjusting device consisting of a rod *F*, a nut *D* adapted to slide thereon, and a screw *E* adapted to operate said nut, said nut being connected to said spring.

Electric Signaling Apparatus and Circuit; F. Benedict Herzog, New York, N. Y..... 315,027

In connection with the latent signal transmitter, described in a previous patent, at the sending station and apparatus at the receiving station for releasing and responding to said latent signal transmitter, there is a calling apparatus at the sending station and an instrument at the receiving station to respond thereto, these instrumentalities being electrically so connected that a call can be sent to the receiving station from the sending station without affecting or releasing the latent signal transmitter at the latter station.

Magnetic Separator; Charles F. Hildes and Ernest Scott, Newcastle-upon-Tyne, England..... 315,028

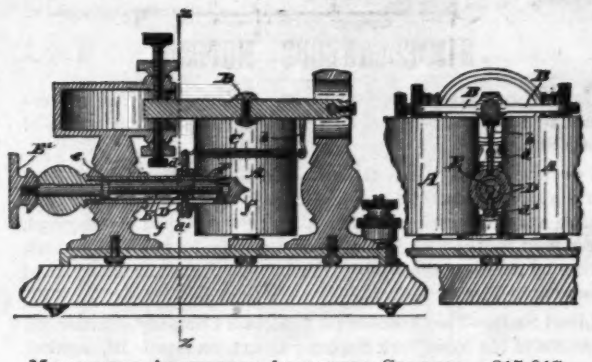
Consists in the combination of two belts, one being a feed-belt and the other a delivery belt, with a magnet-carrying disc which turns above said belts, and circuit making and breaking devices, whereby the magnets of said disc are successively magnetized as they pass over said feed-belt and demagnetized as they pass over said delivery-belt.

Means for Resetting Annunciator Drops; Chas. W. Holtzer, Brookline, Mass..... 315,035

The present invention has for its object to enable all the restoring-magnets of a large annunciator to be controlled by a single key. It consists of a series of indicating instruments, each comprising a pivoted magnetized bar and two electro-magnets by which the said bar is moved in opposite directions on its pivot, combined with a series of normally open independent branch circuits, one passing through one of the magnets of each instrument, and a series of branch circuits connected together in multiple arc, and each passing through the coils of the other magnets of a series of the said instruments and circuit-controlling devices, whereby an electric current is caused to traverse the said circuits.

Electric Gas Lighting Device; John A. Norton, Brookline, Mass., Assignor to Edward E. Bean and Lucius C. Chase, Trustees, both of Boston, Mass., 315,055, 315,056 and 315,057

First. Consists of mechanism for vibrating the movable electrode, whereby it, after passing the fixed electrode and making contact therewith to produce sparks, is moved in the reverse direction below said fixed electrode and clear of the gas-flame; and in a means of short-circuiting the current which passes from the



MEANS FOR ADJUSTING ARMATURE SPRINGS. 315,017.

fixed electrode to the movable electrode out of the mechanism of the apparatus and leading it directly to earth.

Second. Consists of the combination of a movable electrode having a yielding elastic contact-point, and mechanism for actuating said electrode receiving motion from the gas-cock, and a fixed electrode *G*, supported near the gas-escape orifice, and bent over and formed so that the adjacent edges of the standing and bent parts shall be nearer together on one side than the corresponding edges of the said parts on the other side.

Third. The arm *I* being moved downward, the stop-pin *L* engages with the adjacent ratchet-tooth of the wheel *H*. When the arm *I* is released, the plate *N* is retracted by the spring, and the pin *L* then meets the inclined side of the adjacent ratchet-tooth. The result is, first, that the radius of the arm *J* is shorter on the return or back movement than it is on the forward movement, and, second, that on the forward movement of the plate *N* and arms *I J* the cock is rotated with said plate.

Angle-Hanger for Mechanical Telephone Lines; Henry Seligman, Irvington, N. Y., Assignor to Emma Seligman, of same place..... 315,078

A cord is securely attached to both ends of an angle-hanger, and is looped at intermediate points through or over the same and over the line wire in such a manner that the pressure on all the loops will be automatically equalized by the sliding of the cord over its bearings.

Electric Railway; Benson Bidwell, Philadelphia, Pa.. 315,113

Consists of a metallic line circuit composed of tubular conductors having longitudinal slots and interior contact surfaces.

Harmonic Printing Telegraph; George A. Cardwell, Brooklyn, N. Y., Assignor of two-thirds to Frederick K. Fitch, New York, N. Y., and Joseph T. Murray, Newark, N. J..... 315,121 and 315,122

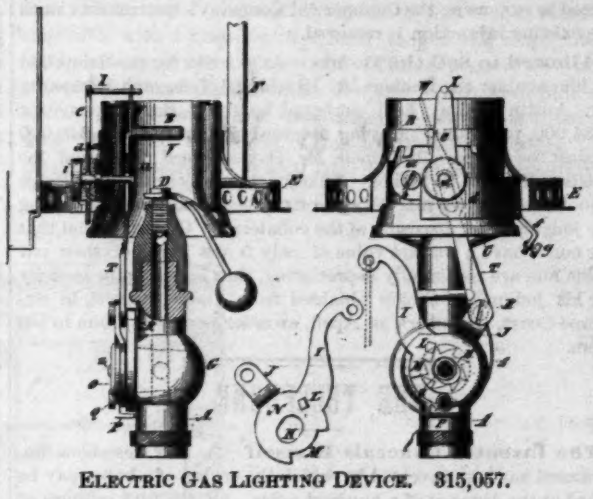
First. Embraces the method of producing telegraphic signals, which consists in the transmission of separate and distinct pulsatory currents of different characteristics, and effecting thereby independent relays which conjointly control printing, recording or sounding devices.

Second. Consists of the combination of two or more relays responsive to different currents, each controlling a receiving magnet and its circuit, and conjointly controlling a third receiving magnet and intermediate electro-magnetic devices, as set forth.

Electric Burglar Alarm; Alvah W. Hall, Meriden, Conn..... 315,139 and 315,140

First. Makes use of a double circuit or system of circuits between the protected structure and the signal-station, one portion of such system being utilized, as is now done, for the transmission of signals; the other for controlling the first in such manner as to produce or to prevent the signal which gives intimation of the entrance to the protected structure, or any unauthorized tampering with the devices, the manipulation of which is a necessary preliminary to such entrance.

Second. A mechanical alarm at the alarm-station is held from operation by a detent controlled by an electro-magnet in circuit with the circuit-closer at the protected station. If the door should be opened, the alarm would ring by reason of release of detent. There is another detent for the same alarm mechanism, controlled by another electro-magnet in a normally open circuit. This detent



ELECTRIC GAS LIGHTING DEVICE. 315,057.

is ordinarily inactive. A set of keys are located near protected station, and when operated in their proper order—*i. e.*, trying for each particular combination—will act successively on the instrument, and close circuit of magnet and lock the alarm, so that the door may be opened without giving an alarm. If operated in any but the proper succession, the alarm will be given, when the door is opened by de-energizing both magnets.

Electro-Magnetic Motor; Charles G. Perkins, New York, N. Y., Assignor to the Imperial Electric Light Co., of same place..... 315,161

The armature is provided with adjustable extensions.

Electro-Dynamic Motor; Frank J. Sprague, New York, N. Y.. 315,179, 315,180, 315,181, 315,182, and 315,183

See description on page 168.

Knob Locking and Releasing Mechanism for Locks; George E. Thaxter, Boston, Mass..... 315,186

Consists of, first, a device adapted to automatically lock the tumbler engaged with the knob spindle of a combined latch and lock when the bolt thereof is projected, so that the bolt cannot be retracted by the rotation of the knob. Secondly, a spring impelled lever adapted, when released, to withdraw the locking device from the tumbler and release the latter; and, thirdly, a detent adapted to normally hold said lever away from its normal position, and adapted to be moved by the closure of an electric circuit on any floor of the building, so as to release said lever and allow it to retract the tumbler locking device, said lever being adapted to be afterward set for action by the retraction of the lock bolt.

Underground Conduit for Electrical Conductors; George H. Benjamin, Short Hills, N. J..... 315,225

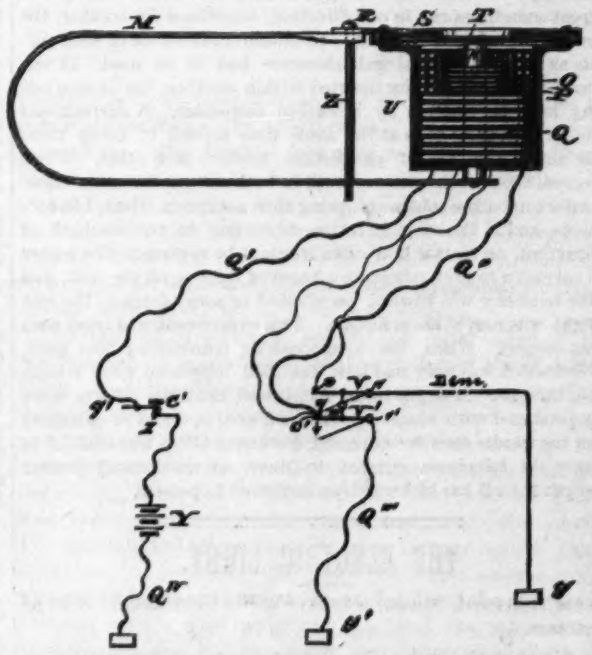
Consists of inclosing within an outer pipe or conduit a number of smaller tubes, each arranged to contain a single wire or conductor. The outer pipe or conduit can be of sheet iron.

Annunciator; James E. McDuff and John F. Doherty, Providence, R. I., Assignor of one-third to Perley W. Cameron, of same place..... 315,313

Consists in the provision of an annunciator in which the closing of one or more electric circuits for the purpose of sounding an alarm or call bell is effected by clock-work.

Multiple Switch-Board; Thomas J. Perrin, Brooklyn, N. Y., Assignor to Charles P. Huntington, New York, N. Y..... 315,332 and 315,333

First. Consists of the combination, in a multiple switch-board,



APPARATUS FOR TRANSMISSION OF MESSAGES BY ELECTRICITY. 315,368.

of a series of main lines, the terminal or connection where each of said main lines enters each switch-board, and a visual indicator at each of said terminals or connections on each board, the visual indicators of each line being automatically operated on all the boards whenever any terminal of said line is plugged.

Second. Consists of the combination of the main line, its connections or terminals on the several boards, operators' instruments normally connected with the main line at its particular board, an electro-magnet at each of said connections or terminals, a local circuit, which includes the coils of said magnets, its contacts at each terminal, plugging or line-connecting devices which complete said local circuit whenever the terminal of said line is plugged to, and devices, actuated by the electro-magnet at the terminal of said line on its particular board, which disconnect the operator's instruments from the main line.

Electrical Switch-Board and Circuit for Telephone Exchanges; Thomas J. Perrin, Brooklyn, N. Y., Assignor to Charles P. Huntington, New York, N. Y..... 315,331 and 315,334

First. Consists of the combination, in a multiple series of switch-boards, of the subscribers' lines and their terminals, each of which comprises the separable contacts, the electro-magnet, the sliding core, the circuit of a local battery, including the coil of said magnet, and the normally open terminals of the local circuit.

Second. He dispenses with the usual magneto call-bell, which, although adopted generally by existing telephone companies, has a great number of serious defects, as is well known by those who have had experience. By employing a single battery of suitable power at the central office much trouble and annoyance arising from the imperfections of the magneto calls at the several subscribers' stations are obviated. By means of a battery more loud and distinct signals may be made both in calling the central office and in calling the subscribers. The arrangement is also useful in case the ordinary subscriber's line which leads to his annunciator becomes grounded or otherwise defective, as any subscriber may then indicate at the central office that his particular line is in trouble.

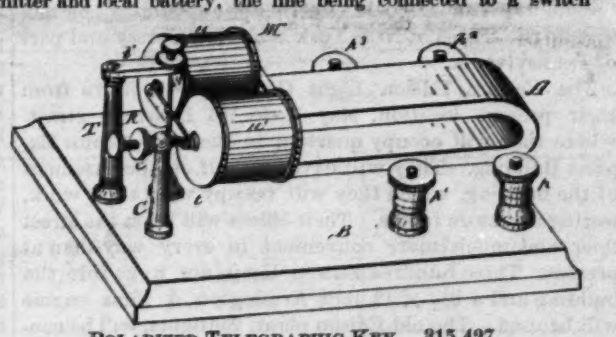
Secondary Battery; Edward T. Reichert, Philadelphia, Pa., Assignor of one-half to Henry D. Welsh, of same place..... 315,339 and 315,340

First. Provides concave troughs on the sides of the electrodes to retain the active material, and of such electrodes combined with double cells.

Second. Consists in the combination of an outer non-conducting wall with an inner detachable non-conducting partition which divides the space inclosed by said walls into two cells, electrodes within said cells, and polarizable material on both sides of said electrodes, the said wall and partition being provided with lateral flanges or ridges.

Apparatus for Transmission of Messages by Electricity; Granville T. Woods, Cincinnati, O., Assignor by direct and mesne assignments to the American Bell Telephone Co., Boston, Mass..... 315,368

The key for varying the current has contacts respectively composed of carbon and a refractory metal. Consists further of a sounder having a helix *O* of high resistance in the line circuit, surrounded by a helix *P* of low resistance in circuit with the transmitter and local battery, the line being connected to a switch



POLARIZED TELEGRAPHIC KEY. 315,427.

which is adapted to cut the low resistance helix into the line, while the high resistance helix is thrown out of action.

Autographic Telegraph; Sylvester P. Denison, New York, N. Y., Assignor of one-half to Robert D. Radcliffe, of same place..... 315,391 and 315,392

First. Consists of an automatic autographic telegraph instrument having the operating stylus or electrode attached to the armature of an electro-magnet fixed to one pole of a permanent magnet, and vibrating over the surface of the substance on which the message is written or is to be recorded, said electro-magnet placed in the main line and actuated by certain changes of polarity introduced into the current on said line.

Second. Consists of instrument having the operating stylus or electrode vibrating over the surface of the substance on which the message is written or is to be recorded attached to or connected with an armature pivoted in the field of a permanent magnet, the said armature being polarized by a helix placed in the main line and actuated by certain changes of polarity introduced into the current on said line.

Telephone; Leon De Socht Labye, London, England. 315,421

There is in combination with a permanent magnet or electro-magnet, provided at one or at both its poles with a coil of insulated wire, a rigid armature of steel or soft iron, freely oscillating around an axis and ending in a hammer, which bears on a rigid obstacle, hereinafter referred to also as the "rigid body," as contradistinguished from the thin flexible diaphragm of the ordinary telephone. The coil or coils on the magnet is or are interposed in the telephonic circuit.

Rheotrope or Current Reversing Key and Polarized Telegraphic Key; John C. Ludwig, San Francisco, Cal., Assignor of three-fourths to Louis A. Garnett, of same place, and John Hewston, Jr., Brooklyn, Cal..... 315,426 and 315,427

First. Consists of the combination, with a pivoted key-lever, of two metallic arms projecting therefrom at angles to its axis and insulated from each other, each of said arms being arranged to vibrate between a separate pair of contacts, and the contact on each arm being electrically connected with an opposite contact of the other arm.

Second. Consists of the combination, with a permanent *A* and an electro magnet *M*, having its two cores similarly polarized by one of the poles of said permanent magnet, of an oscillating neutral armature *R*, having its opposite ends arranged within attractive distance of the electro-magnet cores, respectively.

Induction Apparatus for Telegraphy; John C. Ludwig, San Francisco, Cal., Assignor of three-fourths to Louis A. Garnett, of same place, and John Hewston, Jr., of Brooklyn, Cal..... 315,425 and 315,428

Consist of the combination, with one or more pairs of magnetically-polarized cores having opposite poles adjacent to each other, of coils of wire surrounding said cores and connected, and a stationary electro-magnet having a pole inductively adjacent to but separated from the poles of each opposing pair of said cores,